The Art of Mordanting and Staining

THE ART

OF

MORDANTING

AND

STAINING

AND THE COMPLETE TREATMENT

OF

WOOD SURFACES

A HANDBOOK AND AID FOR ARCHITECTS, CABINET MAKERS, DECORATORS, PAINTERS, PIANO FACTORIES AND TRADE SCHOOLS

BY

WILLIAM ZIMMERMANN

INSTRUCTOR OF CHEMISTRY IN POLYTECHNIC INSTITUTE, BARMEN, GERMANY

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PREFACE

Since the appearance of the Fifth Edition of this work in 1908, it has again been considerably enlarged and revised and the results incorporated in the present Sixth Edition.

In the portion relating to staining, the chapter on Brown Stains, which occupy an important position in connection with modern furniture and fittings, has been completely revised and enlarged by the introduction of the new and practically-tested Special-Oak Stains, Anthracene Stains and Genuine-Mahogany Stains, which have been very favorably received.

Because of their lesser importance, the number of staining formulas for bright colors has been diminished, but these have been replaced by staining formulas for new products of greater fastness to light.

All suggestions and experiments since the last edition have been incorporated here. The Sample Card of colors (in the Supplement) has been made to correspond with the new formulas in the book.

The rapid distribution of five preceding editions has demonstrated the earnest patronage accorded me, and I now place this Sixth Edition with the public in full confidence that it will prove an authoritative adviser in all problems pertaining to wood-staining.

WILLIAM ZIMMERMANN.

BARMEN, APRIL, 1910.

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The Art of Mordanting and Staining

At the great expositions recently held in Dresden, Nuremburg, Reichenburg (Bohemia) and in Berlin, it was demonstrated anew with what importance color is regarded as a factor of modern interior construction. Seldom, if ever before, have there been exhibited such simply-constructed rooms whose effect was obtained almost exclusively by color scheme.

Undoubtedly color is one of the strongest means of impressing the human mind. Through its agency may be produced an atmosphere of warmth and cheer or a contra effect of cold and repellency; a stately, dignified interior, or walls emanant of festive brightness. It is essentially a predominating force, and being also the cheapest auxiliary means of decoration, its practicability as applied to the dwelling rooms of those moderately circumstanced is highly evident.

Craftsmen, cabinet-makers, decorators, painters, and all whose calling is associated in some measure, great or small, with the use and application of stains and mordants, should be, as a matter of course, thoroughly familiar with the primary essentials of preparation, both of the surface to be stained and of the stain-composition itself, in order to achieve clever results.

The first attempts at staining our domestic uncolored woods a certain designated tone, were made with the object of imitating the magnificent and gorgeously-colored, but expensive, tropical woods; and also of staining the naturally light young wood the prized dark tone peculiar to old wood.

It is only recently that domestic uncolored woods have been stained all conceivable colors not inherent to the natural wood. When this new branch of cabinet-making had its inception a few years ago, and prominent artists and artisans offered their services, they suggested novelties other than the usual brown tones thus far used, with the intention of treating the entire room according to one designated color scheme.

The somewhat crass colors used at first, such as bright green, blue, etc., have, of course, given way to more subdued, intermediary tones,—faint blue-green, greenish-gray, gray-brown, etc.

Advantages of Mordanting Wood as Compared With Body-Colors and Glazing

Among experts and the intelligent public to-day, stained wood is in high favor, and to the art of wood-staining is therefore opened an ever-increasing field of application. The foundation of this method of coloring various objects and constructions of wood depends on that property common to all wood-staining,—of retaining and intensifying the natural texture and marking characteristic of each species.

That this requirement cannot be met by means of the formerly universal method of painting the wood with body colors is very evident, as all body-colors consist of insoluble materials which are applied with the help of proper binders, such as linseed-oil, varnish and turpentine in more or less thick coats. On account of their impermeability to light, as the very name implies, they cover the entire surface of the wood so completely that it is no longer possible to recognize its species.

The artificial graining subsequently executed with stencils and transfer-paper or by free-hand over this coating, does not deceive the eye; for even though an artist's

handiwork, it is easily distinguishable from the natural wood grain.

If the coat of varnish subsequently applied to protect the glazing or graining color has been worn off in spots by repeated washing or otherwise, then this layer of color adhering only to the outer surface of the wood is soon worn away and the bare wood shows.

The new technics of wood mordanting, or wood staining, are based on entirely different principles.

The dyes or chemicals used are perfectly soluble in water or other solvents, such as turpentine or alcohol, so that these dyes and chemicals, penetrating with their solvents (water, turpentine, alcohol) up to a certain depth in wood, remain therein when the solvents evaporate, thus according a stained surface.

In many instances of wood-staining, the dye is actually generated (chemically) in the wood fiber and left there by means of the consecutive effect of two proper chemicals, or by the effect of chemicals on the tannic acid already in the wood.

In whatever manner the staining is done, whether by means of solutions of prepared stains, or by means of the reciprocal action of chemicals on each other, there is always an actual staining of the pulp of the wood up to the depth of one-half to three-fourths of a millimeter, to which the mordant solutions actually penetrate within the wood.

On this property of the stain, to penetrate into the pulp of the wood itself and to deposit there the dissolved stain, rests its capacity for sharply intensifying the structure of any kind of wood. The pulp of different kinds of wood is by no means of uniform hardness and density. In particular the annual rings in our domestic evergreens are always harder than the wood in between. But in the harder deciduous woods also, where the difference between the annual rings and the rest of the wood is not so marked, there are always differences in the density of separate parts of one and the same surface.

The penetrating capacity of the staining solutions is favorably or unfavorably influenced by these differences in density and hardness of the separate parts of one surface. In the softer parts of the wood the stain not only penetrates deeper, but greater quantities of it are absorbed than in the harder and denser portions. Hence in the softer parts of the wood there is a much greater amount of color deposited than in the harder parts, corresponding to the increased assimilation of the stain; and after staining, these appear darker, generally showing a more tinged shading than the harder parts. This is especially characteristic of evergreens, such as firs, pines, pitch-pines, Carolina pines and yellow pines. By the various absorbent qualities of soft and hard parts in the same surface is to be explained the fact that the marking and silver grain of the wood, which are scarcely visible in its natural state, come into prominence after staining with an enhanced beauty due to the tinged shading.

Therefore it will be perceived that the staining of wood not only affords us a desired color effect, but presents unchanged the natural marking characteristic of each species. The process has taken its rank among the foremost arts of the day, and it is hoped to accord within these pages a comprehensive aid to its higher advancement and utmost perfection.

Properties of a Good Wood Stain

Because of the long periods of usage given wood-structures, we require of a stained wood in the first place, resistance to the effect of light and air. But this is not the only essential; there are a large number of chemicals and dyes which are very fast to light, and yet are not fitted for wood-staining.

A wood stain, to fulfil all requirements for use, in addition to its light-proof quality, must be easily and clearly soluble and remain clear in its solution; must pene-

trate deeply into the pulp of the wood, intensify strongly the natural marking, and when staining large surfaces, be uniform and spotless. Furthermore, its application must be simple, the result certain, and the cost to manufacture be low.

Fastness to Light and Air

The fading (bleaching) of all colors and dyed materials is caused by the usual effect of the sun's rays in conjunction with the oxygen in the air and the moisture always in the atmosphere. By the combined effect of these three agents all dyes are changed in a longer or shorter period of time into colorless substances, or else undergo decided changes in tone. This is true not only of wood stains, but also of all natural and artificial dyes in general; therefore also for body-colors, glazing-colors and colors with which our clothing material is dyed or printed.

The French chemist, Chevreul, has shown experimentally that fading of dyes and dyed materials cannot occur in sunlight alone without the presence of air and moisture. But this knowledge has never been availed of up to the present time, as we have not been able to preserve our diversely stained, mordanted, glazed and painted wooden objects in an absolutely dry and air-free room. Therefore we have to reckon with the factor that in the course of time all colored objects change or lose entirely their original tone. Absolutely light-proof products are lacking both in natural as well as artificial dyes; however, the length of time required for light and air to work such thorough changes in dyed materials varies extraordinarily.

On the one hand, while we possess dyes which in a direct light totally change, or entirely lose their original tone after a few days, on the other hand there are a number of such products which resist a direct light for many months without any considerable change, and last many

years practically unchanged in the exceedingly dry air of our dwellings and in the sunlight which is diffused in them.

The darkening and deadening of the natural or artificial coloring of the wood in furniture is by no means to be attributed to a change in the dye alone, but is due principally to a change in the ground-color of the wood. It is universally known that wood especially rich in tannin, such as oak, mahogany, and also walnut, darken very decidedly on account of the effect on the tannin in the wood by the ammonia always in the atmosphere, a phenomenon which is called the "aging of the wood."

But also woods with little tannin, such as fir, pitch-pine, maple, etc., lost their bright, natural color and become yellower and darker upon long exposure to light and air.

According to the length of time it takes for a decided change in the original tone of a colored object, due to the influence of light, air and moisture, are made the differentiations,—practically fast, medium fast, and fading, or fugitive colors.

While the artificial dyes in use commercially up to 1880 had very little fastness and had no general application to wood-staining, among the innumerable recent coal-tar derivatives we have a sufficient number of such dyes which not only equal the natural vegetable dyes in light-proof qualities, but in most instances far surpass them.

Among the two thousand and more artificial dyes used commercially to-day in the various factories, it is not easy to select those which are fast to light and air and are therefore adapted for wood staining. It requires a thorough knowledge of the properties of the various coal-tar dyes which only the specialist in this branch can have.

Unfortunately this most important requirement of fastness to light in a good wood stain was given very little attention until recently. About fifteen years ago, when men first concerned themselves with the achievement of stains in modern tones, fugitive dyes dating from the very

first aniline period were deliberately used. Enjoyment of the results obtained was therefore short-lived, and it seemed probable that the new manner of modern wood-staining would perish in embryo; for once a more or less legitimate prejudice based on sad experience has settled on the purchasing public, the impression is lasting and cannot be dispelled until its deep-rooted effect has been overcome.

It would be unfair to place upon the cabinet-makers responsibility for bygone mistakes, for they could use only those dyes and wood stains for their work which were offered as available by the dye-works and wood-stain manufacturers, and these were almost, without exception, of decidedly inferior quality.

In general the following rules apply to the fastness to light of wood stains:

1. With the chemicals and dyes available at the present time, water-stains can be made which satisfy all reasonable requirements as to fastness to light. But dyes absolutely fast to light cannot be made, either with natural vegetable dyes nor with artificial dyes.
2. As regards fastness to light, mineral dyes are much superior to vegetable dyes and aniline dyes, but they cannot be used for wood-staining because they are insoluble, and hence do not fulfil the basic requirement of penetrating into the fiber of the wood and maintaining the natural marking.
3. Alcohol stains, as well as turpentine and wax stains, usually have only a very medium fastness to light and do not equal the good water-stains in this respect. Among alcohol, turpentine and wax stains, gray and black stains are the most light-proof.
4. The capacity of a stained-wood surface to resist the effect of light is furthermore dependent on the intensity or the depth of the tone in each individual case. A dark tone is always faster than a medium, and the latter has more resistance than a light stain,

if the same stain or the same dye is used in each instance. The following examples may demonstrate this: For Case 1, stain one square meter of a certain kind of wood a very strong dark tone, so that 10 grams of the dye are absorbed by the wood; for Case 2, one square meter of the same wood with the same stain but in a lighter tone, so that only one gram of the dye is absorbed by the wood. Set both tests in the light simultaneously. In a certain length of time, due to the destructive effect of the sunlight, in conjunction with the air and moisture, a certain amount of the dye, say 0.5 gram, is dissipated. With the dark-stained wood 9.5 grams of the dye remain intact, so that the stained wood is only a trifle lighter (5%) and seems somewhat duller. With the light stain on the other hand, half of the dye (50%) is dissipated; this seems very much faded and changed in tone, and yet in both cases the same stain has been used. This example shows us further that in making experiments in exposure to the sunlight, the same depth of color must always be used in order to obtain a conclusive decision concerning the respective fastness to light.

5. The layer of shellac, varnish or wax always covering stained wood, protects the stain from the effect of water, and prevents the penetration of rays of light only to a slight degree; hence delaying the dissipation of the dye by light but a trifle.*

6. If it is necessary to mix two or more shades to get a certain tone, only such colors should be chosen as possess practically the same fastness to light. For example, if an orange, fast to light, and a green, not fast to light, should be used for an olive-green stain, the green would fade in a short while and the stain would quickly change to orange,—that is, the stain would become discolored.

*Schramm and Jungle: Interior Decoration, April, 1906.

Every user of wood stains should possess an independent knowledge of their light-proof qualities and personally obtain the test by simultaneous exposure to light of small stained, shellacked or varnished boards. These comparative experiments must be made with equal conditions and during the months of May to September; for in the fall or winter months the sun's rays have little effect, and the experiments may very easily deceive. They should be conducted behind a pane of clear glass fixed obliquely toward the south, so that the sun's rays can fall as nearly as possible vertically on the stained surfaces. In determining the degree of fastness to light, the simultaneous exposure of a stain of recognized excellent fastness to light and of one which is not, is necessary in order to ascertain in which category the stain under exposure should be included.

In the description of individual stains, their power of resisting the effect of light will always be discussed in detail.

Deep Penetration of the Stain Into the Pulp of the Wood

In applying the liquid stains, especially water-stains, the grain of the wood is more or less raised, and in order to facilitate a perfectly smooth surface, a thorough rubbing with curled hair should be given before the subsequent shellacking, matting, etc.

If the stain does not penetrate deeply and the wood is only surface stained, it is easily rubbed through, especially at the edges, exposing the raw wood in spots. This untoward occurrence is usually to be feared if the wood has been subjected to some quick polisher, such as sandpaper, etc., applied under too great pressure.

Rubbing through is avoidable by the following precautionary measures:

1. Dampen surfaces to be stained with a very moist sponge, but do not rub until the pores have swelled

and the grain is raised. Thoroughly sandpaper without pressure or scouring. Surfaces polished in this way have the grain raised very little when staining with water-stains.

2. For polishing the mordanted surface use only horsehair or perfectly smooth sandpaper. The latter is preferable with large-pored woods like oak, as horsehair often dislodges the stain from the pores. (Only "OO" sandpaper should be used, and that when it is worn so it no longer catches on wood.)

The greater or lesser depth to which stain may penetrate into the pulp of the wood depends largely upon the density or hardness thereof. Obviously the liquid applied to hard wood cannot penetrate so deeply as in soft wood.

A large amount of resin in the wood will also greatly impede the penetration of the staining solution because of its fatty elements. Thus the penetrating qualities of individual groups of stains are very diverse.

Alcohol stains penetrate deepest into the wood. Next in order come water-stains, and lastly the turpentine and turpentine-wax stains. The latter, however, always stain merely the surface of the wood. The following general rules are to be observed for obtaining the deepest possible mordanting of the wood:

1. The wood should be placed in a warm room several days before staining so that the pores will open and make possible a better penetration for the staining solution.
2. With hard woods the staining liquids are generally to be applied hot, as they penetrate deeper than when cold.
3. The stain should be applied with a well-saturated brush or sponge, so that the surface becomes quite wet. The liquid can then be left some time to penetrate into the wood before the application of the softening brush for evening the stained surface.

4. Resinous woods should be washed off before the staining or waxing with a solution of 50 grams of calcined soda (pulverized soda) in 1 liter of hot water; or very resinous woods with a soda acetone solution (for preparation and use, see pages 29-32). After the resin is removed the wood should be washed with warm water.

Preserving the Natural Marking of the Wood

An essential requirement of a good wood stain is that it shall preserve intact and intensify the natural marking characteristic of each kind of wood, whereby the layman may recognize its variety or species. To this single capacity of the stain is to be ascribed its almost universal use to-day as a finish for wooden constructions of general artistic utility.

Only a stain which has the property of being perfectly soluble in water or other solvent, and which contains no small particles in suspension, can penetrate into the fine pores of the wood and stain it without leaving a deposit on the surface partly concealing the marking.

For this reason all staining solutions which are not perfectly clear, or contain the slightest residue, should be filtered through cotton cloth before using, in order to remove all undissolved particles. These fine undissolved dyes or impurities settle in large-pored woods, such as oak, causing an unsightly punctured appearance, and cannot be removed, even with the most careful rubbing.

For the same reason all staining solutions which have the property of settling after long standing or of segregating from their solvent, must be brought into solution again before using, by warming or boiling, and filtered again.

The intensification of the texture and marking of the wood after staining is to be explained by the varying density and hardness of the wood itself. As already stated,

in almost all woods there are hard and soft places. A greater quantity of liquid is absorbed by the soft parts, and after staining they appear darker than the hard parts, due to the latter's lesser absorption.

This is especially characteristic of pine, fir and pitch-pine, in which the annual rings always appear lighter stained than the rest of the wood.

If for any reason a decided intensification of the marking is not desired in these woods, the surface should be sponged off before staining with a solution of one part Arti-Equalizer, thinned with two to four parts hot water; rubbed after drying, and then stained.

Another method of obtaining a partial balance in the intensity of the tone in woods of very diverse hardness and density, consists in mordanting such surfaces very wet and immediately taking off the superfluous solution with a well-squeezed sponge before it has time to penetrate far into the soft parts of the wood. Previous rubbing of evergreen woods with one part raw linseed oil and one part turpentine before staining does good service in balancing the hard and soft annual rings, as the linseed oil taken up by the soft parts of the wood prevents too great absorption of the staining solution.

The glazing of wood with oil or water glazes (often falsely called stains by painters), has nothing in common with real wood-staining, as the glaze, which is an insoluble body-color, cannot penetrate nor even be rubbed into the wood, but rather is deposited on the surface, and so the marking of the wood never retains its original natural beauty.

Spotless and Uniform Staining of Large Surfaces

A well-stained wood does not need such a uniformity of tone as is required in monochrome cloth. But on the other hand, as has already been mentioned in the previous

chapter, an intensification of the marking by contrasting its light or dark coloring with the uniform surface is very effective. However, light or dark spots caused by faulty application of the staining solution, by resinous places or by undissolved or secreted bits of dye, are unsightly and troublesome. Naturally it is much more difficult to stain a large surface uniformly than a small one.

The wood itself is a very important factor toward the even application of stain. If it contains knots and sap-wood, uniform staining is practically impossible. Because of its porous character, sap-wood absorbs a large quantity of the staining solution, which causes it to assume a considerably darker appearance and often a different color from that of the dense heart which takes up much less of the staining fluid. Oak wood is an exception in that the darker heart is always darker than the lighter sap-wood. Of course the sap-wood proper is not meant, as this must always be cut out because of its great liability to become worm-eaten. Also, knots and other defects in the wood are not covered up by staining as they are when coated with body-color, and therefore show plainly.

Irregularity of surface may be further caused by putting on the stain with a half-dry brush. The amount so applied is insufficient and too quickly absorbed by the wood, so that a subsequent balancing with the softening-brush is impracticable, as the strokes of the brush are then clearly visible.

The wood should always be stained as wet as possible in order to insure uniformity of tone.

The objection expressed by many cabinet-makers that this method tends to raise the grain more, is incorrect; for experience has shown that with meager applications of the staining solution the wood swells exactly as much as when it is applied very wet. When staining large areas, therefore, the following rules are strictly to be observed:

1. The brush used should always be well saturated with the staining solution, so that as much as can be absorbed is applied to all parts of the wood, and it is, to a certain extent, super-saturated.
2. For large surfaces use a sponge or woolen cloth instead of a brush. Before applying the stain therewith, however, the sponge or cloth should itself be first immersed in the staining solution and well-squeezed, to thoroughly impregnate it with the color. Then saturate, and proceed as with brush.
3. Every stained surface, after the application of the solution, must be wiped off uniformly with a well-squeezed sponge or well-wrung woolen cloth, in order to remove any possible irregularities in the distribution of the stain over the entire surface, and also the surplus stain.
4. On very large surfaces where there is danger that the first-stained portion will partly dry before the softening-brush can be applied, both staining and softening must be done at the same time,—one workman applying the stain in liberal quantities while another softens it immediately, before the surface becomes dry.
5. The so-called "lapping" of the color when applying the staining solution until the brush is nearly dry (a method used by painters in applying body-color and all too often in staining wood), should be rejected absolutely, as every stroke of the brush is clearly visible on the stained surface, leaving a far from artistic effect.
6. The temperature of the staining room should be as uniform as possible, neither too warm nor too cold.
7. If several pieces of furniture are to be stained the same color, one man should do them all, for if several men are entrusted with the work and one man stains wetter than another, the furniture so stained will always come out lighter than that stained dryer.

8. Before staining coniferous woods, wash them with a solution of one part Arti-Equalizer and four parts hot water, by means of a sponge, and let dry; then sandpaper and proceed to stain.
9. Coniferous woods may also be rubbed before staining with a mixture of equal parts of raw linseed oil and turpentine. After the linseed oil has dried, sandpaper and stain.

These preliminaries reduce to a minimum the raising of the grain on the surface when staining with water-stains.

Uniform success in staining large surfaces, however, is entirely dependent on the chemical character of the stain used. We distinguish especially two groups of dyes which may be used for water-stains: (1) basic dyes and (2) acetous dyes.

The basic dyes, which, up to a short while ago, were used almost entirely for wood-staining, especially in the manufacture of the liquid and solid water-stains ready for use commercially, are not only very slightly light-proof, but are fixed and retained very rapidly by the fibers of the wood; so that a subsequent balancing to obtain a uniform distribution of the stain is almost entirely illusory. Many mistakes made with water-stains unfortunately are to be ascribed to the use of these basic dyes for wood-staining. Because it was often impossible for the cleverest stainer to obtain a uniform surface with these water-stains composed of basic dyes, there formerly existed a general opinion that water-stains were unsuited for application to wood.

The acetous dyes, in addition to being much more light-proof, have the great advantage of being fixed very slowly by the fibers of the wood. Hence they have sufficient time to penetrate very deeply into the pulp of the wood, and likewise any possible irregularities in the distribution of the stain can easily be balanced by subsequent rubbing or wiping.

Therefore it can be strictly maintained that the introduction and vitality of modern staining technics is in

great measure due to a general use of the acetous group of dyes for manufacturing staining solutions.

If experience shows that the uniform staining of any wood offers special difficulties, then a preparation of the surface before staining is mandatory.

Preliminary Treatment of the Wood Before Staining

If resinous woods, such as Carolina pine, fir and especially pitch-pine are to be stained, they must first be freed of the resin found in the outer layers of wood, by the method described on pages 29-32.

But even with non-resinous woods a treatment with this process is very desirable in order to obtain perfectly-uniform staining.

I. Preliminary Treatment with Linseed Oil

Rub the surface to be stained with a mixture of equal parts of linseed oil and turpentine, preferably with a woolen cloth. Make circular motions (as in polishing) and leave the wood twelve to twenty-fours hours to dry.

The oiled surface should then be thoroughly sand-papered, after which the staining solution can be applied at once with the precautionary measures indicated.

This preparation of the surface of the wood with linseed oil has still another collateral effect. The penetration of the oil prevents warping of the fibers and pores when the wood is stained, so that an after-polish with horse-hair or a piece of felt is sufficient to obtain an absolutely smooth surface. If the wood is to be stained in very delicate or bright colors only decolorized linseed should be used when oiling.

II. Moistening with Water the Surface to be Stained

Moistening the surfaces to be stained with quantities of water is done principally when staining coniferous woods, such as fir, pine, Carolina pine, pitch-pine and oak; first, because this renders a slower and more uniform absorption of the staining solutions later applied, and secondly, it diminishes the all too conspicuous difference in the intensity of tone between the hard and soft parts of a single surface. Saturate the entire surface with a thoroughly wet sponge, let the water soak into the wood for a few minutes, and then stain immediately with water-stain.

With oak, this washing with water has an additional advantage in that the subsequent application of stain has less tendency to raise the grain. When washed well with warm water the glue, which has penetrated through the veneer, is almost entirely removed, thus eliminating the possibility of unsightly glue-spots.

III. Preliminary Treatment of the Wood with Arti-Equalizer

The best treatment of the wood, as denoted in I and II above, is given with Arti-Equalizer.

It is a fact known to every specialist that soft woods, especially coniferous woods (fir, pine, Carolina pine and pitch-pine), are considerably more difficult to stain than hard woods, and sometimes even an expert may not be successful in obtaining the desired uniformity of surface. To overcome this condition a preliminary treatment of the wood with Arti-Equalizer before polishing and staining will be found sufficient. It is particularly advisable also to employ this method with woods that have been previously oiled for any reason, as oiled surfaces (especially if the oil was not applied smoothly and the linseed has become hardened by long exposure to the air) do not take

the stain uniformly, and obviously prevent its deep penetration into the wood.

The method of applying the Arti-Equalizer is as follows:

Dilute one liter of Arti-Equalizer with four liters of hot water and thoroughly wash the surface to be stained with a sponge; let the wood dry completely, rub the surfaces perfectly even with sandpaper or pumice-stone and then stain with water or turpentine stains in the usual manner.

This preliminary treatment with Arti-Equalizer obtains results as follows:

1. The grain may be raised slightly, but if, when the pores and fibers of the wood swell, they are rubbed well without exerting much pressure and without depressing them completely, this condition will not be present when the staining is completed.
2. When coniferous woods have this treatment the alternating light and dark coloring of the annual rings does not show so conspicuously.
3. The spongy, felt-like portions of fir and pine wood, which show their dark coloring in the form of ugly spots when the wood is not previously treated, take the stain after treatment almost as evenly as the other parts.
4. Preliminary treatment of coniferous woods with Arti-Equalizer effects a removal of the surface resin, so that woods not having an excess of resin, such as fir and pine, do not require a separate process for its elimination.

This method of preliminary treatment can be used with equally favorable results for hard woods.

NOTE: The preliminary treatment of the wood with Arti-Equalizer can only be used in those cases in which actual dyes, such as acetous aniline or Olesole dyes are used. If chemicals, such as sodium chromate, green vitriol, pyrolignite of iron, potassium permanganate, protochloride of copper Z, or the various oxidine stains recommended for the manufacture of water and light-fast stains are used, then treatment with the Arti-Equalizer is not admissible.

IV. Preliminary Treatment of Coniferous Woods with Benzoic Solutions Before Staining

Preliminary treatment with a spirituous solution of benzoin has a very good effect in obtaining a uniform staining of coniferous woods. A strong benzoin solution is made by dissolving ordinary benzoin in high per cent. denatured alcohol.

Add enough denatured alcohol so that the bubbles will remain at the top after the solution has been thoroughly shaken in a bottle, and let stand ten seconds. If the bubbles disappear in less than ten seconds the solution is too weak, and more of the concentrated benzoin solution must be added. If the bubbles last ten seconds after shaking, then the solution is ready for use. Wash off the coniferous wood with a sponge soaked in this solution, let the surface dry, sandpaper and stain in the usual manner with water-stains.

When coniferous woods are prepared in this way not only are uniform tones of color obtained, but also the hard annual rings are less conspicuous by their light coloring, and the grain is raised less after staining.

V. Preliminary Treatment of Oak with Solution of Sodium Chloride

In the deep pores of oak and also of ash there are found air bubbles which render exceedingly difficult the penetration of the stain and often prevent it entirely.

If oak with very deep and small pores is stained with dyes, whether water, turpentine or alcohol stains, these solutions cannot penetrate the air-filled pores in spite of strong rubbing, and after the surface has dried the pores appear unstained.

To prevent this often very troublesome evil, the following preliminary treatment of oak surfaces has proved excellent:

Rub the rough oak surfaces with the hottest possible solution of 100 grams sodium chloride (common salt) in 1 liter of water, applying with a thoroughly saturated sponge; let this dry twelve hours, sandpaper the surface and stain with water-stain in the usual manner. The dye now penetrates better into the pores, and as the grain is raised very little by the water-stain, slight rubbing is sufficient to obtain a perfectly smooth surface. On oak which has been prepared in this manner the color of the stain is clear and strongly defined.

Any salt remaining in the wood has absolutely no bad influence on the dye nor on subsequent matting. The treatment of oak with salt is a perfect substitute for the so-called watering, and the latter can hence be omitted if the surfaces have this treatment.

NOTE: If Oxidine stains or Antique-Oak stains, Special Oak stains, Anthracene stains or stains made only of chemicals (no dyes) are used for staining oak and ash, then the treatment with salt is not required, as these stains are so strong that they can penetrate even into the pores filled with air-bubbles. (For method of supplementary staining pores left white when staining oak furniture, etc., see chapter entitled "Process for Subsequent Covering of Unstained Pores of Stained Oak.")

Staining Cross-Grained Wood

The staining of cross-grained surfaces offers many difficulties. Cross-grained wood absorbs every staining solution greedily and in large quantities in the direction of the fiber, because of capillary attraction; and hence, even when staining with relatively weak solutions, the tone is quite dark and often almost black.

For this reason cross-grained surfaces are not stained simultaneously with, nor in the same manner, as wood cut with the grain; but are always handled separately and usually receive preliminary treatment. This treatment consists of depositing an insoluble substance, or a substance difficult of solution, in the fibers of the cross-grain; this

prevents the strong absorption of the staining solution.

Such substances are: thin solutions of glue or much-thinned shellac.

Paint the previously-polished surface of the cross-grained wood with one of these solutions, let it dry, sand-paper again, and then proceed to stain. These solutions must, however, be used very thin; otherwise the wood prepared in this way may be unfitted for the subsequent application of stain.

It is furthermore desirable to dilute the staining solution that the color may not come out too dark. Usually the stains used on wood cut with the grain should be thinned to one-third to one-fifth of their original strength for use on cross-grain surfaces.

Another way to prevent too dark staining of cross-grain surfaces and carved work is to wipe them off with a well-squeezed sponge or woolen cloth immediately after the staining solution has been applied, so that the stain still on the surface is removed before it can be absorbed by the fibers of the wood.

Removal of Surface Resin from Resinous Woods Before Staining

Fir, pine, Carolina pine and especially pitch-pine, largely used by carpenters and cabinet-makers, always contain a greater or lesser quantity of resin, whose presence can be recognized by the odor and the greasy touch peculiar to these kinds of wood.

The presence of this resin renders exceedingly difficult the staining of the woods mentioned above, as its greasy, water-repelling qualities have a very detrimental effect on the penetration of the staining solution into the pulp.

This repellency becomes a veritable calamity if the resin is very unevenly distributed in the wood and there are especially resinous places in it. The staining solutions applied are more or less strongly absorbed by different parts

of the wood, according to the greater or lesser amount of resin present.

Even when the stained surface is wet it inspires little confidence, and after it has dried, light and dark spots show in turn, which does not tend to exert an artistic effect on the beholder.

There are often observed accumulations of resin in the surface of the wood which absolutely prevent the absorption of any stain in these places.

Every time such a resinous spot is gone over with a brush or sponge full of staining fluid, the solution runs off into the wood surrounding the resinous spot, and the wood shows in this place with its own natural color.

Because of less expensive grading, the resinous woods above-mentioned are employed to a considerable extent in interior finish, and to a certain degree in the manufacture of low-priced furniture; and as modern choice favors stained wood because of its very apparent retention of natural beauty and marking, it is imperative that this undesirable secondary element be eliminated in so far as is possible.

All methods of removing the resin from roughly-worked furniture and other woodwork can naturally only result in removing it from the upper layers of the wood, as a removal from the interior would seem absolutely impossible for technical reasons. Still, an attempt should be made to remove the resin from the outside of the wood up to the depth to which staining solutions may penetrate, viz., ½ to 1 mm.

A practical method of doing this is based on the capacity of a solution of soda to reduce the resin to a resin-soap, soluble in water.

Method I

Dissolve fifty grams of calcined soda (pulverized soda) in one liter of hot water. Rub hard on the surface of the wood with this solution, using a sponge or a brush; then

wash off with clear water, preferably warm, in order to remove the resin-soap and soda still remaining in the wood.

A more intense and quicker method of removing the resin is achieved by the simultaneous use of an energetic solvent which is added to the soda solution.

Such a solvent for resin, working intensively even at ordinary temperature, is acetone, a hydrocarbide, used in trade as a clear, translucent liquid.

Acetone, unlike benzol, benzine, etc., has the property of mixing to a certain degree with water and the above soda solution without isolating itself; and for removing resin is far superior to all other hydrocarbides, as well as volatile oils, e. g., turpentine and the alcohols. Its peculiar odor, similar to that of benzine, does not inhere in the wood, as acetone, like very volatile substances, evaporates in a brief while.

The effect of acetone mixed with the above soda solution is twofold:

1. It dissolves the resin in the outer layers of the wood. This resin is partly washed off directly in this dissolved state, and partly by the presence of the soda is converted quickly and easily into resin-soap soluble in water, as may be the case when the soda solution has to react on resin still hard; for every chemical reaction (and such is the conversion of the resin into soap) proceeds more energetically and rapidly if both of the reacting substances are in dissolution.
2. The acetone penetrates much deeper and more rapidly into the pulp of the wood than a simpler soda solution, thus causing a deeper removal of the resin. Following is another method:

Method II for Very Resinous Wood

Dissolve 50 grams calcined soda (pulverized soda) in 1 liter of hot water. Let the solution cool, and mix immediately before use with ¼ liter of acetone.

Wash the surface vigorously with this preparation by means of a sponge, and the resin-soap and soda left in the wood may be removed by washing with clear warm water. When dry, sandpaper and stain.

The given ratio of soda to acetone must be strictly maintained. For thorough removal it is absolutely necessary that the surface be rubbed hard and continuously with a sponge saturated with either Solution I or II.

As may be seen, these methods remove the greater part of the resin at or near the surface of the wood; but at the same time the resin still remaining, which was not converted into a resin-soap soluble in water nor dissolved by the acetone, will be quite regularly distributed over the entire surface; so that conditions are very favorable for a uniform absorption of the staining solution.

NOTE: Pure acetone is a very inflammable volatile substance and should therefore be kept only in well-closed receptacles. When pouring out or handling this liquid, no open flame should be allowed near.

The ratio of 1 liter 5% solution of soda to ¼ liter acetone must be strictly followed, as these two liquids do not remain permanently mixed in other ratios.

Acetone should only be mixed with solution of soda when it has cooled.

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Acetone should only be mixed with solution of soda when it has cooled.

Preliminary Treatment of Wood Already Oiled Before Staining

In new buildings the mouldings and doors are often oiled before being put into place, or immediately thereafter.

This oiling is to prevent too much absorption of moisture by the wood from the fresh plaster, and so putting a check, to a certain extent, upon warping. Furthermore, the oiling offers a certain protection against the dark

brown spots so easily caused by lime, mortar and cement, especially on oak wood.

If these oiled doors and wooden mouldings are sandpapered and stained immediately after oiling, as a rule there is no special difficulty.

But if the linseed oil has hardened through long exposure to the air, the layer of resin forming on the surface offers great resistance to the penetration of staining solutions, and stains very easily become spotted and irregular.

In this case also it is necessary to saponify the linseed oil on the surface of the wood by energetic washing with a solution of 50 grams of pulverized soda (calcined soda) as hot as possible, and to wash off the resulting resin-soap, soluble in water, with warm water exactly as was described in Method I, "Removal of Surface Resin from Resinous Woods Before Staining." When dry, sandpaper.

NOTE: Care must be used, when washing with warm water, surfaces treated with the soda solution, to remove all the soda left in the wood, as this may eventually destroy subsequently-applied mordants, or change their shades, resulting in the formation of discolored spots in the stained surface.

Simple Method of Using a Wood Stain and Certainty of Its Result

Such stains are naturally preferred as give the desired coloring to the wood with only one application. More than two applications, with one or two different staining solutions, is, in most instances, quite impracticable, because the assurance of the ultimate success is endangered so much the more as different stains, and several applications thereof, are required to obtain a certain color.

Therefore, ready-prepared dyes, especially acetous aniline dyes, as well as the Special-Oak stains and Anthracene stains, are generally preferred to the above-described wood-stains, as they produce dyes in the wood itself by the reaction of two different chemicals. Stains produced

in this way, when applied to certain kinds of wood, usually create shades of color very different from each other; and even when used on one and the same kind of wood, the color obtained is seldom of equal intensity and shade.

Thus, there are difficulties in the way of successful results with staining by use of chemicals, and such staining requires that the most painstaking care and accuracy be observed in the preparation of the solutions, as well as in their working. Furthermore, though staining with two different chemicals generally requires one or two days for absolute development of the tone, and also increased work, the fastness to light of the color obtained is scarcely any greater than with the present light-proof water-stains,—acetous aniline dyes, Special-Oak stains and Anthracene stains. The use of chemicals is to be recommended only for a special requirement, e. g., that of being water-proof; or when special effects are to be obtained. (Fumed stains, Oxidine stains, etc.)

It is further recommended that experiments be first made on small pieces of the same wood before staining, in order to be certain of obtaining the exact color desired or prescribed; and if necessary to dilute the stain with water, turpentine or alcohol, according to its nature, until it is of the desired proportions for use.

General Rules for Staining Wood

For staining wood, not only is a knowledge of the manufacture and use of the various staining solutions necessary, but a rational application of the stain requires also a certain knowledge of the different kinds of wood with regard to their relation to the individual stains; for very diverse effects are often obtained with one and the same stain,—a condition based upon the widely-varying chemical compositions of wood. A very important factor is the presence of tannin, in great or lesser quantities, which has a chemical

reaction on many stains, and with these produces variously-colored lacs in the fibers of the wood.

Two examples may explain this:

1. If fir or pine, which do not contain much tannin, are stained with a solution of 50 grams of potassium chromate in 1 liter of water, the wood assumes merely a light yellow color, corresponding to the color of the potassium chromate, and this, by the way, has absolutely no fastness to light, and is therefore worthless.

   But if oak wood, which is very rich in tannin, is stained with the same solution, it will immediately assume a beautiful yellowish brown color, which also offers great resistance to light and air; for the tannin in the oak combines with the potassium chromate which has penetrated into the wood and makes a brown dye, which settles between the cells of the wood.

   The same is true in staining mahogany and walnut with potassium chromate, as these woods also contain a considerable quantity of tannin.

2. If fir or pine is stained with a solution of 20 grams of green vitriol in 1 liter of water, scarcely any staining will take place.

   But, on the other hand, if ash is stained with the same solution, a beautiful medium gray is obtained, and when applied to oak, a strong bluish-gray appears. This effect is also to be attributed to a combination of the green vitriol with the tannin of the wood, and the more tannin in the wood the darker the resulting stain.

The amount of tannin in the wood is of especially great influence on the shade and depth of the tone obtained by staining with all stains which contain metallic salts as effective elements, as is the case with Antique-Oak stains and all Oxidine stains. On woods rich in tannin this stain not only produces a darker and richer tone than on woods

with a medium or small amount, but the resulting tones on woods with diverse amounts of tannin generally differ considerably from each other.

Also the varying density or hardness of each kind of wood has a great influence on the result of the staining. In a soft wood, the staining liquid not only penetrates deeper, but also more of it is absorbed than by a hard, dense wood. Hence in the first case, with one and the same staining solution, a considerably stronger and richer stain is obtained than in the latter case.

Therefore, for a certain designated tone, a weak staining solution should always be chosen for soft woods, and a correspondingly stronger solution for hard woods.

But even in staining the same kind of wood, one should not count on an entirely similar result of staining with one and the same staining formula, or with the same solution.

The amount of resin and sap present at the time of the felling of the wood will often offer a very diverse resistance to the penetration of the staining solution, so that the result may be lighter one time and darker the next.

A clever stainer can offset these generally slight differences in the depth of the tone while he is staining, either by going over the harder parts again immediately or by letting the stains remain longer before he softens them and removes the surplus. Slight corrections can be easily made by wiping off the darker spots immediately with a well-squeezed sponge or woolen cloth.

The amount of tannin in wood is not always the same throughout. It is dependent on the age of the wood as well as on the climatic conditions of its place of origin. For example, Hungarian oak always has more tannin than the German, and the American oak less.

Therefore, this difference in the amount of tannin is of considerable importance if the tannin of the wood is to produce a dye in the fibers of the wood, as is the case in the

fuming of oak, gray-staining with green vitriol or iron mordant, staining with Antique-Oak stains, etc.

On the other hand, when staining woods with acetous aniline dyes the amount of tannin plays no part whatever.

The ground-color is often very different in the same kind of wood and causes a very considerable difference in the tone finally obtained, especially in light and delicate colors.

So there is scarcely any difficulty in getting light and delicate tones, such as blue-gray or silver-gray, on woods with a light natural color, such as maple and willow; whereas it is often very difficult and many times even impossible to get the same delicate tones on oak, which is colored considerably darker by nature, or on Carolina pine, which has a very yellow ground-color.

On account of these varying reactions, not only of different kinds of wood, but even of the same kind of wood, it is almost impossible to be sure immediately of getting the exact tone desired.

It is advisable to determine accurately beforehand, with staining experiments on a small board, prepared the same as the article to be stained, in what strength and composition a staining solution must be applied in order to be sure of obtaining a certain previously-prescribed tone.

If the prepared stock solutions described on pages 40-42 are used, the attainment of a certain tone offers no difficulties and causes no great loss of time.

The tone obtained by staining cannot always be determined immediately after applying the stain, especially if it is one which gradually develops through the influence of the air, or one that is slowly generated in the fibers of the wood. In these instances the effect of a stain cannot be determined for a day or two.

Stained wood must always be allowed to dry a day or two in ordinary temperature before being treated with a coat of varnish, shellac or wax.

If the wood is still damp, this would effect the varnish or shellac, which would soon become dull and show white spots which are hard to remove.

If two or more staining solutions are to be applied in succession, the succeeding solutions should not be used until the preceding one is dry, requiring an interval of six to twelve hours.

Not all dyes which are available and recommended for wood-staining can be used and mixed simultaneously. This is always to be taken into consideration in using aniline dyes.

In particular, dyes of the basic group should never be mixed with those of the acetous group.

The dyes of these two great groups act toward each other like two hostile brothers.

If an acetous solution is mixed with a solution of a basic dye, both dyes in common are precipitated, the solution becomes turbid, fine sediments are formed, and often also resinous secretions.

Such a staining solution is absolutely useless. It cannot penetrate into the wood and would make an unsightly, spotted stain, not light-proof. Great care should therefore be taken in the manufacture of staining solutions to keep them continually clear. It is a good plan, before mixing solutions of various aniline dyes whose acetous or basic character is not exactly known, to make a preliminary test in a goblet and to observe the solution after it has stood awhile. If the originally clear solution is turbid and opaque, it is a sign that a secretion of dye has taken place.

For the same reason it is not permissible to mix acetous and basic dyes in the dry state (pulverized), as when dissolving such a mixture, there is the same undesirable precipitation with all its disagreeable results. The aniline dyes recommended in this book for the manufacture of water-stains all belong to the acetous group, and hence can be mixed with each other at will. On the other hand, all

dyes which are given for the manufacture of alcohol stains and turpentine stains are of a basic nature.

Many stains have the property of assuming a bronze shimmer when the surface of the stained wood dries, that is, it presents a yellowish, greenish or copper-colored metallic luster.

This occurs especially with dark, somber stains, but seldom with light and medium stains.

The bronze tone disappears, however, immediately after the stained surface has been treated with a coat of shellac, varnish or wax.

Hence an approximate estimate of the color resulting from the stain, based on the appearance of the wood when still wet, is not always conclusive.

The Dissolving of Dyes and Chemicals

The solution of all materials for the manufacture of stains must be prepared with the utmost regard for the cleanliness of receptacles.

The most important solvent for all chemicals and dyes is water. Ordinary well or city water generally contains considerable quantities of lime and magnesium, and often iron salts, which partly precipitate the dyes and chemicals. These dissolved salts segregate for the most part, after long boiling, and adhere to the sides of the receptacle as boiler-scale.

Hence, for dissolving dyes and chemicals, either condensed water from steam pipes or else previously scalded water only, should be used.

Not all dyes and chemicals are equally well and quickly soluble in the various solvents (water, alcohol and turpentine).

The dissolution of all dyes and chemicals, however, can be hastened by:

1. Use of a hot solution, either by warming or boiling.
2. Good shaking or stirring during the dissolving, and

3. Previous pulverization of the substances to be dissolved, if they come in the shape of pieces or crystals.

Only a certain amount of each substance can be dissolved in the boiling solvent.

As a general rule much larger quantities of a substance are soluble in a boiling solvent than in the same solvent at ordinary temperature. Hence, it follows that when the solvent cools a corresponding amount of the dissolved substance will segregate, and finally only so much remains in solution as can be dissolved by the solvent when cold.

Hence solutions which cool off while being used or which have to be kept for later use, should contain no more of a dissolved substance than it can hold in solution at ordinary temperature.

All solutions of dyes and chemicals which are not perfectly clear must be filtered before use, in order to wholly remove any undissolved particles.

The dissolving of all dyes and chemicals should be done in glazed or enamelled receptacles which can be easily cleansed and have no injurious effect on the chemical substances.

Simplified Method for Manufacture of Staining Solutions Ready for Use. (Stock Solutions)

Stains in all colorings can be simply and quickly prepared from the stock solutions of the various dyes.

To make stock solutions: Dissolve 50 grams of each dye in 1 liter of boiling water; stir constantly, filter through a fine-meshed cotton cloth, and keep in closed glass or earthen jars.

These stock solutions may be kept indefinitely, and no segregation of the particles takes place if water free of lime is used for dissolving the dye.

Water of this nature can easily be obtained in any place where there is steam power or steam heat, by inserting a large water-separator (condensing-plug) at the

lowest part of the pipes as far as possible from the boiler. The amount of water accumulating in this is sufficient for dissolving all dyes and chemicals. If this procedure is impossible, use rain-water or water which has been boiled a long time.

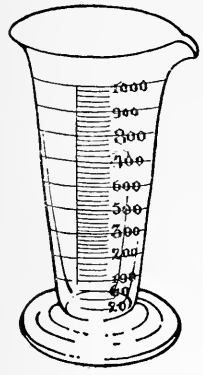

Fig. 1

With the aid of a glass liter measure (Fig. 1) with 1-10 liter gradations and a glass measuring tube (Fig. 2) with cubic centimeter gradations and a capacity of 100 cu. cm. (1-10 liter), any desired quantity of stock solution can be measured off quickly and accurately, and by mixing two or three corresponding stock solutions, every staining solution can be made at will.

Fig. 2

If the stains made from stock solutions prove to be too strong for medium and light colors, they can be diluted with water. A filtering is therefore no longer required.

NOTE: On cold winter days, if there should be any secretion of dye, in individual stock-solutions, such as Crocein Scarlet, Pyrotine Red, Mahogany Brown "D" and Walnut-Brown "R," pour the solution into an enamelled dish and heat it. This will render it clear and ready for use.

Each stock solution contains:

per liter	(1000 cu. cm.)	50	grams	dissolved	dye
" ½ "	(500 " ")	25	"	"	"
" ¼ "	(250 " ")	12.5	"	"	"
" $\frac{1}{10}$ "	(100 " ")	5	"	"	"
" $\frac{1}{50}$ "	(20 " ")	1	gram	"	"

In making the various stains with stock solutions it should be remembered that every 20 cu. cm. of stock solution contains 1 gram of solid dye in solution.

Therefore if 2, 5, 10, 20, 30, 40 or 50 grams of solid dye are to be used, then 2 × 20, 5 × 20, 10 × 20, 20 × 20, 30 × 20, 40 × 20 or 50 × 20 = 40 cu. cm., 100 cu. cm.,

200 cu. cm., 400 cu. cm., 600 cu. cm., 800 cu. cm., or 1000 cu. cm. of the stock solution is to be measured off.

Two examples may explain the use of the stock solution:

No. 1. A. Formulas for a powerful Olive-green, with Weight of Materials

35 grams New True-Green,
8 " New Yellow, and
7 " Nigrosine. Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

B. Manufacture of the same Staining Solution (with Stock Solutions)

700 cu. cm. New True-Green (stock solution),
160 " " New Yellow (stock solution), and
140 " " Nigrosine (stock solution), are mixed together.

1000 cu. cm. = 1 l liter staining solution ready for use.

No. 2. A. Formula for a medium Stone-gray, with Weight of Materials

8.5 grams Nigrosine,
0.5 " True-Yellow "G,"
1.0 gram New True-Green. Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

B. Manufacture of the same Staining Solution (with Stock Solutions)

170 cu. cm. Nigrosine (stock solution),
10 " " True-Yellow "G," (stock solution),
20 " " New True-Green, (stock solution) and diluted with
800 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

In this way any staining solution can easily be prepared in five minutes, and requires neither boiling water nor exact balance scales or nest of small weights.

The following aniline dyes of the acetous group are the chief ones used in the manufacture of stock solutions:

1. Nigrosine, soluble in water
2. " T, " " "
3. " G,
4. Induline W, " " "
5. Azine Blue, " " "
6. Indol Blue
7. New True Green
8. Indol Blue Green
9. True Yellow G
10. New Yellow
11. New Orange
12. Persio Red
13. New Red

All these dyes belonging to the same acetous group can be mixed in any ratio to obtain the various intermediary shades desired.

Likewise all the following Brown water-stains, which also belong to the acetous group, can be prepared in stock-solutions:

14. Walnut "R," soluble in water
15. " "G," " " "
16. Mahogany Brown "H," soluble in water (light mahogany)
17. Mahogany Brown "D," soluble in water (dark mahogany)
18. Rosewood Brown, soluble in water
19. New Brown "A" " " "
20. " " "B" " " "
21. " " "C" " " "
22. " " "D" " " "
23. " " "E" " " "
24. " Gray-Brown "F" " " "
25. " " " "G" " " "
26. " Olive-Brown "H" " " "
27. " Brown "J" " " "
28. Oak Stain "H" " " "

All these stains can be mixed with each other at will, and also with those numbered 1-16.

On the other hand, a mixture of water-stains with alcohol or turpentine-stains is not admissible, as the two latter belong to the basic group of dyes.

NOTE: This simplified method of staining solutions ready for use with previously prepared stock solutions has always worked very satisfactorily in actual practice.

For the formulas in this book for making brown, gray, green, olive, red, yellow, orange, blue and violet water-stains, the weights of the dyes and the quantities of stock solutions used are given in cu. cm. per 1 liter staining solution.

Low Cost of Manufacturing the Staining Solutions

The home preparation of the various staining solutions, according to the simple methods given in this book, has the following advantages:

1. The user of wood stains knows in each individual instance exactly what dyes or chemicals his stains contain, hence his assurance in working is much enhanced.
2. Home preparation offers a guarantee of the always invariable compositions of the stains, their properties and degree of purity.
3. The knowledge of the composition of the individual staining solutions and their properties makes it possible for the user to decide himself in most instances which of the stains given in this book he will have to employ to produce a certain effect.
4. The low prices at the present time, of dyes and chemicals necessary for the manufacture of the various staining solutions, afford such considerable pecuniary advantage over the use of the prepared staining solutions of commerce that every regular consumer of wood-stains should make his own, if only for purely economical reasons.

The manufacture of all the wood-stains described in this book is exceedingly simple and requires no knowledge of chemicals or other practical instruction.

Water-stains are naturally the cheapest, as the only expense is for the necessary chemicals and dyes.

None of the water-stains described will exceed 20c per liter, and most of them can be made for much less.

As 1 liter of water-stain will stain 7–8 square meters of wood, according to its greater or lesser density, the cost of the staining materials can be practically ignored.

With turpentine stains the expense is considerably more, as the cost of the solvent has to be added.

Alcohol-stains cost about the same, owing to the relatively high price of high per cent. alcohol, even of denatured, but especially on account of the much greater consumption of an alcohol-stain per square meter of wood, due to its very energetic penetration into the pulp of the wood.

Preservation of Dyes, Chemicals and Staining Solutions

All dyes, whether coal-tar or vegetable, and all chemicals, should be kept in well-closed receptacles in dry, but not too warm, places, for many dyes have the property of being hygroscopic and then caking together in lumps which are hard to dissolve; or else they dissolve into a thick mass.

If kept in hot places, aniline dyes and also vegetable dyes cake into a compact mass, rendering them difficult to remove from the receptacle and hard to dissolve.

The chemicals for wood-staining must also be kept absolutely closed and in a dry place, because they are apt to absorb the oxygen from the air, which changes and renders them of slight or absolutely no use.

All staining solutions cannot be preserved a long time. Some must be prepared fresh every day, but those

which will keep should be placed within tightly-closed glass or earthen jars, as metal receptacles are unfit for the purpose.

If there are insoluble secretions in a liquid after standing a long time, it should be reheated or boiled and filtered again before use.

When mentioning the individual wood-stains, their greater or lesser durability in this direction will always be given prominence.

A. Water-Stains

Water-stains are solutions or decoctions of natural or artificial dyes, and of chemicals in water.

The group of water-stains contains the most light-proof representations among wood-stains. This does not mean that all water-stains must be light-proof, for, unfortunately, there are many water-stains used in commerce whose capacity for resisting light is of very modest dimensions.

With the dyes and chemicals now available, we can manufacture water-stains which fulfil perfectly all reasonable requirements in fastness to light and air; whereas with alcohol, turpentine and wax stains, the dyes adaptable to their manufacture do not possess these resistant qualities.

The objection formerly voiced against water-stains, that they rendered an irregular and spotted surface, is not admissible nor authentic now, for this fault concerns only wood-stains manufactured from basic dyes, which are fixed too rapidly by the fibers of the wood, so that the subsequent balancing or softening process does not give a uniform distribution of the stain over the entire surface.

The acetous aniline dyes universally recommended in this book for the manufacture of water-stains are fixed by the fibers of the wood almost as slowly as the excellent turpentine stains, so that every irregularity due to the

application of the staining solution can be completely removed by subsequent use of the softening brush, sponge or woolen cloth on the still wet surface.

The only disadvantage of water-stains is their property of more or less raising the grain of the wood, so that a supplementary rubbing with sandpaper, horsehair or hard felt is required. For this reason some cabinet-makers and painters prefer turpentine and wax stains, which raise the grain scarcely at all, and therefore do not require as much after polish.

However, the possessors of articles stained with turpentine and wax stains are greatly disillusioned when they perceive how rapidly the colors which were so beautiful at first fade or change completely.

This disadvantage of water-stains in raising the grain of the wood can be restricted to a minimum if the surfaces to be stained are thoroughly saturated with water and well sandpapered without pressure or scouring; and also by employing the preliminary treatment for surfaces (linseed oil, Arti-Equalizer, benzoin solution, or common salt solution) described on pages 24-28.

Only those water-stains will be described here whose durable qualities satisfy strict requirements and which have been proven through practical use and repeated exposure to the sunlight.

Brown Stains

Brown stains, with their many variations, occupy the most important position to-day in wood-staining, after the gradual liberation from bright colors, such as green, olive and blue.

They are used:

1. To imitate the naturally colored, precious and high-priced woods (foreign), such as mahogany, walnut, rosewood, etc., that is, to give our domestic uncolored

and cheap woods the appearance of these precious woods by means of staining.

2. To give young, light-colored oak the appearance of old, dark-colored oak.
3. To obtain the gray-brown, smoke-brown, dark and black-brown tones of recent favor for domestic woods.
4. To enliven and intensify the natural coloring of precious woods, such as mahogany, walnut, rosewood, etc.

Antique Oak Imitations

All woods rich in tannin possess the property of assuming, after a few years, a tone considerably darker than when newly cut, the apparent phenomenon being designated as the "aging of the wood."

This change from the original color is most evident in oak, which surpasses all other woods in the amount of tannin contained. The dull brown tone it assumes after long periods of use is developed through the influence of ammonia (always present in small quantities in the air) on the tannin of oak in the presence of air.

This so-called Antique-Oak color, characteristic of century-old furniture or interiors, was formerly attained only through the process of time; but now its much-prized beauty may be artificially produced by the ingenious and simple method of fuming with gaseous ammonia.

Fuming of Oak

The fuming of oak is done as follows:

Oak articles to be stained are first carefully sandpapered, then placed in a vacant room, care being taken that they do not touch each other. On the floor of the room, according to its size, put one or more dishes of concentrated ammonia (also called spirits of sal-ammoniac),

close all doors and windows as tightly as possible, and let the articles remain for a day under the influence of the evaporating gaseous ammonia. This, in collaboration with oxygen present in the air, acts upon the tannin of the oak, obtaining that dull brown tone of antique appearance which would otherwise result only from many years' exposure to atmospheric influences.

Furniture factories where such procedure is a regular undertaking, usually have a specially-constructed chest of matched boards with large doors, but any moderately-sized room which can be tightly closed is available for the purpose.

Each piece of furniture before fuming should be completely finished and put together. In selecting the wood it is advisable to get it all from one trunk, or at least to obtain wood of the same age and which has been dried the same length of time. The veneers must be as similar as possible to the solid wood in quality, color and structure; and in the execution of especially expensive or particular work, both solid wood and veneer should come from one trunk.

All metal trimmings, etc., on furniture must be removed, and if it is not desired to have all portions share in the fuming process, the interior of drawers, cupboards, etc., should be given one or two coats of shellac, which will render the wood impervious to change.

Glue, polish, fat, or smudges caused by contact with soiled hands must be completely removed from exterior surfaces before fuming.

Each separate article must be set up by itself in order that it may be submitted unhindered to the influences of the ammonia gases.

The fuming of all the fittings of a room should be done at one time to insure uniformity of coloring. If it is desired in a new house that one or more rooms be executed in antique-oak finish, merely place several dishes of ammonia therein, shutting tightly all doors and windows;

and in one or two days' time, wainscotting, mouldings, etc., are stained a fine, delicate brown. For a room of ordinary size, five liters of the strongest spirits of sal-ammoniac are sufficient. If the ammonia evaporates too slowly in winter, owing to the low temperature, put a few pieces of quick but unslaked lime into the dishes containing same. The lime, being slaked by the water in the ammonia, heats it, thereby producing rapid evaporation.

The depth of tone obtained by this fuming process is dependent, in the first place, upon the amount of tannin in the oak.

NOTE: Articles fumed with gaseous ammonia should be washed and matted after a day or two, so that the ammonia which has penetrated within the wood can be thoroughly removed; for if the wood still contains ammonia, it will be imprisoned by the subsequent application of shellac or varnish, and has, furthermore, a destructive effect upon them.

Intensified Antique Oak Staining

If the oak wood to be stained contains only a small amount of tannin, or if it is desired to have a very dark and powerful stain, assistance may be had by increasing artificially the amount of tannin in the wood.

To do this, the oak should be mordanted before fuming with a solution of 25 to 50 grams of pyrogallic acid in 1 liter of water, sandpapered lightly and submitted to the effect of ammonia fumes in the manner previously described.

This may also be done if the antique tone obtained by the fuming has come out too light. In this instance, air the objects well in order to rid the pores of all ammonia, then stain with a solution of 25 to 50 grams pyrogallic acid in 1 liter of water; sandpaper after the stain has dried, and submit again to the fuming process.

If a very dark antique color is desired, it is better to experiment first in fuming a small piece of prepared oak,

to determine whether the tannin is actually sufficient to make dark staining possible.

If the experimental staining comes out too light, the prepared oak contains too little tannin; therefore the amount must be increased by preliminary mordanting with a pyrogallic acid solution. The wood should be sandpapered after the mordant has dried, and then fumed.

If the wood or veneer for the same article, or for the various appointments of a room, is not cut from one trunk, the object will emerge from the fuming chamber with some portions much darker colored than others, oftentimes occasioning its rejection by the customer.

In this instance also, a supplementary staining of the light places with a correspondingly strong solution of pyrogallic acid, and refuming, is an excellent method for offsetting the irregularities in the tone of the stain acquired.

Sapwood, which contains scarcely any tannin, can be given a preliminary or supplementary staining with a solution of 50 to 100 grams of pyrogallic acid per liter of water, and then fumed.

This Antique-Oak stain produced by the effect of gaseous ammonia possesses the following advantages:

1. The gaseous ammonia penetrates deeply into the pores of the wood. Thin boards are stained almost throughout.
2. As the gaseous ammonia completely fills the entire room, it comes into absolutely equal contact with all the free parts of the wood, according a uniform coloring, impossible to attain with liquid stains.
3. The grain is not raised in fuming. Supplementary sandpapering is therefore unnecessary.
4. The process is inexpensive: for an ordinary room, 3 liters of ammonia is sufficient to give an antique stain to all oak parts.
5. In fuming, the markings of oak are brought out darker than other parts, thereby enriching the

surface beauty, but, unfortunately, tones obtained by the fuming process alone are not absolutely permanent and become lighter in time.

NOTE: The solution of pyrogallic acid used for deepening the tone of the antique oak must always be prepared fresh just before using.

Antique Oak Staining with Grayish-Brown Tone

The grayish-brown tone, very popular in antique stained oak furniture, is usually obtainable by direct fuming only when the prepared oak is very rich in tannin. A preliminary mordanting of the oak with pyrogallic acid produces only a more intensive antique-oak tone which falls short of the desired gray shade.

A simple method of deepening the gray-brown tone obtained by fuming, is to color the wax to be used on the furniture with Olesole Black "BG."

To do this, in a receptacle placed over boiling water, melt 1 kilogram of wax in ¼ liter of turpentine, add about 5 to 10 grams Olesole Black "BG" and stir with a wooden paddle until the mixture shows a uniform gray coloring,—a matter of several minutes. Treat the fumed furniture with this wax preparation in the usual manner.

DARKENING THE FUMED TONE

A simpler method than preliminary or supplementary staining of the oak with a solution of pyrogallic acid and subsequent fuming for strengthening the tone, is the coloring of the wax with Olesole Antique-Oak Brown. To prepare: In a receptacle placed over boiling water, melt 1 kilogram of wax in 200 to 400 cu. cm. of turpentine, add 5 to 10 grams Olesole Antique-Oak Brown. If the tone is desired somewhat grayer, add at the same time 1 to 2 grams Olesole Black "BG" and stir with a wooden paddle until the mixture shows a uniform coloring.

With this prepared brown wax, fumed furniture can be handled as nicely as when using the uncolored wax.

Those portions which have come out too light in fuming, because of the small quantity of tannin contained, may be remedied by using the prepared wax on the light places and treating the rest with uncolored wax.

If the articles are not to be waxed, but matted in some other way, they must be stained over with a solution consisting of 5 to 10 grams Olesole Antique-Oak Brown in 1 liter turpentine, or a solution of 2 to 4 grams Olesole Black "BG" in 1 liter turpentine.

Subsequent sandpapering of these corrected parts is not necessary, as the grain of the wood is not raised by the turpentine stain.

Antique-Oak Staining of Woods Containing Little Tannin by Means of Fuming

If woods containing little tannin, such as beech, fir, pine, Carolina pine, etc., are to be stained a characteristic oak tone by fuming, it is necessary to supply the missing tannin artificially. Pyrogallic acid is the best of the natural and artificial tannins for this purpose.

Ground the sandpapered wood with a hot solution of 50 to 100 grams pyrogallic acid in 1 liter of water (according to the depth of tone desired), soften the staining uniformly and let dry. Smooth with sandpaper or horsehair and put in the fuming room, where the process is the same as with oak. The dull brown tone obtained differs very little from fumed oak.

This method of fuming woods poor in tannin with ammonia, to an Antique-Oak tone, has been proven very practical in new houses where the mouldings, doors, brackets, etc., of a room are of oak, while the ceiling is beamed with cheaper wood. If the beamed ceilings are given a preliminary staining in the above manner with a

correspondingly strong solution of pyrogallic acid, then all the fuming can be done in one operation.

It is always better to experiment first and see how strong the pyrogallic acid must be in order to get the desired Antique-Oak tone. This may be done by staining small boards of the same wood with solutions of 50, 75 and 100 grams pyrogallic acid in 1 liter of water, and after drying and sandpapering, putting them in an air-tight wooden chest to fume over night, together with the samples of oak wood.

Lightening the Fumed Stain

It sometimes happens that the Antique-Oak tone obtained by fuming is too dark and must be lightened.

It may also occur that an article desired in its natural coloring is placed in the fuming room by mistake, thus necessitating a means for removal of the darker tone obtained. Because of the fastness of the dye produced in the wood by fuming, the lightening of the dull brown color offers some difficulty. A complete removal of the stain is frankly impossible.

The best results are obtained by the following process:

Dilute 1 part of commercial hydrochloric acid, free of iron, with 3 parts cold water, and wash off the articles stained too dark with this solution; let the hydrochloric acid work for several hours and repeat the process if the tone is still too dark. Then remove the hydrochloric acid by vigorous rubbings with cold water; sandpaper after drying, and matt as usual.

But if it is desired to give fumed furniture a light tone as near the natural as possible, one or two washings with diluted hydrochloric acid is insufficient. In this instance it is necessary to wax the furniture washed and treated as above with a yellow-colored wax in order to press the still remaining brown color through same.

To prepare: In a receptacle placed over boiling water, melt 1 kilogram bleached wax in 100 to 200 cu. cm. turpentine. Add a solution of 5 to 10 grams Olesole Yellow and 1 to 2 grams Olesole Orange, and stir with a wooden paddle until the mixture is uniformly yellow. When cold, apply in the usual manner. After several days the furniture should be brushed and polished.

NOTE: For washing off fumed oak, only hydrochloric acid which is absolutely free of iron should be used, as even a slight trace may cause gray spots and streaks. Only hydrochloric acid which is colorless, is free from iron. If it is slightly yellow this reveals the presence of ferric chloride and such hydrochloric acid is unavailable for the above use.

Antique-Oak Imitations with Light-Proof Water Stains

It was shown in the chapter, "Intensified Antique-Oak Staining," that weighty disadvantages accrue to the process of Antique-Oak staining by fuming with ammonia. These disadvantages are attributable to the varying peculiarities of oak wood, and in particular to the difference in quantity of tannin contained; therefore they cannot be completely avoided.

To obtain uniformity in fumed furniture it is necessary to select oak of the greatest possible similarity of structure and possessing approximately the same amount of tannin.

Because of the uncertainty of this method, many furniture manufacturers have discarded the fuming process and obtain the desired antique tone by direct staining with water-stains.

Water-stains producing Antique-Oak Browns in varied tones, from light dull-brown to dark gray-brown, are classified in two groups:

1. Ammonia Antique-Oak Brown stains "J," "K," "L" and "S," composed entirely of chemicals, liquid; and Antique Brown stain "M," liquid; used

for staining tannic oak without preliminary mordanting, and

2. Prepared New Brown stains made from light-proof aniline dyes, used for staining oak and all other woods, as the presence or absence of tannin in the wood in no wise affects their results.

Preliminary Treatment of Oak Before Staining

Oak furniture before staining should be thoroughly saturated with warm water applied with a clean sponge. This raises the grain, necessitating a sandpapering of the surfaces when dry. The subsequent application of stain does not cause further swelling of the pores, and the tone obtained is of greater depth and uniformity than if the wetting process were omitted. A still better way is to wash off the surface of the oak with a solution of 100 grams cooking salt per liter of warm water, or with weak ammonia water (50 cu. cm. concentrated ammonia per liter of water); for these solutions raise the grain more energetically than pure water. Saturating the surface with a weak solution of pure ammonia opens the pores at the same time, so that subsequently applied staining solutions can penetrate better and deeper into the wood. It is invariably advantageous to saturate oak before staining, and especially advisable with veneered furniture.

In hot pressing glued oak veneer, the thin glue penetrates very easily through the large and deep pores, and combines with the dyes of the stain, causing the pores to appear much darker than the surface after staining. If the glue which has penetrated into the pores comes to the surface, those portions of the veneered furniture stuck with it do not take the stain readily, and light spots appear which can be removed only by long sandpapering while wet.

If veneered oak furniture is well washed off before staining with warm water or weak ammonia, the glue

which has penetrated through the pores and the glue on the surface is freed, distributed evenly, and in parts entirely removed; so that it can have no ill effect on the staining. The saturated oak surfaces are carefully sandpapered and then brushed with a steel brush immediately before staining, to rid the pores of fine sawdust and air-bubbles, thereby affording the stain a better penetration.

Antique Stains "J," "K," "L," "S" and "M"

These purely-chemical liquid stains, ready for use, penetrate deeply within the wood, according light to medium antique tones of special beauty and regularity; rendering unnecessary a subsequent sandpapering. They stain the pores completely without blotching in any way.

Because of their excellent qualities these preparations are often used as grounding stains with a subsequent application of the New-Brown stain or other acetous aniline dyes, to produce darker or intermediary tones unattainable by the use of the Antique-Oak stains alone; and also for obtaining redder, greener or grayer modern oak tones.

Because of their great penetrability, Antique-Oak stains permeate thin coats of wax and matting without necessitating their removal, thus constituting darkening stains for already matted natural-colored or light oak furniture.

The great advantage of these preparations for staining oak is their property of combining with the tannin contained therein, thus according yellow-brown, dull-brown and gray-brown tones.

If desired to produce very powerful tones with oak stains alone, it is necessary to effect a corresponding increase of tannin by previous mordanting of the wood with a solution of 10 to 25 grams of pyrogallic acid per liter of hot water; then stain this grounded surface with Antique stains in the usual manner. For woods with little tannin, the Antique-Oak stains alone are insufficient.

All Antique-Oak stains can be mixed at will in order to get intermediary tones, but there may also be added to them a small quantity of the acetous dye previously dissolved in hot water for shading either up or down.

No. 1. Light Yellowish Oak Tone

To previously saturated and sandpapered oak apply Antique-Oak stain "J," very wet; let it penetrate sufficiently into the wood, and then soften.

Remarks: 1. In all staining with Antique-Oak stains, the immediate result is a very powerful dull, reddish-brown tone which does not assume its decisive hue until about twenty-four hours; this grows lighter for forty-eight hours, and then remains set. Thus, if oak furniture is to be matched with other, even though stained with the same Antique stain, it must stand several days before absolute similarity can be assured.

2. The full beauty of tone obtained with Antique-Oak stains is not apparent until after rubbing with curled hair. If desired, surfaces may be waxed and polished.

3. If oak furniture grounded with Antique-Oak stains is to be coated with acetous aniline dyes, e. g., New-Brown stains "A," "B," "C," "D," "E," New Green-Brown "F" and "G," etc., it is best done when the grounded surfaces are still moist, as the stains will combine better in the moist state.

4. If light tones are desired, the Antique-Oak stain can be diluted with ammonia-water. (Use the proportion of 25 c.c. ammonia to a liter of water.)

5. If the tone produced by Antique-Oak stain alone is desired redder, greener or grayer, a small quantity of Persio-Red, New True-Green or Nigrosine, soluble in water, can be added and the result obtained with one staining. For this purpose use the stock solutions of acetous aniline dyes.

6. A large quantity of acetous dye should not be added to the Antique-Oak stain, as an insoluble precipitate is produced by the chemicals in solution to it.

7. If desired to employ Antique-Oak stains for the purpose of darkening already matted oak furniture, add 50 cu. cm. ammonia per liter of stain, that it may better penetrate the coat of shellac. Apply this combination very wet; leave it long enough to remove the shellac, and then soften.

8. If already matted oak furniture is to be stained very dark brown tones, the Antique-Oak stain is not sufficient. For this purpose use the liquid Special-Oak stains I–XVI, double concentrated, properly diluted with cold water and 50 to 100 cu. cm. ammonia per liter of stain, in order to penetrate the matting.

No. 2. Old Oak Staining with Dull Brown Tone

To previously-saturated and sandpapered oak apply Antique-Oak stain "K," exactly as in Formula No. 1, and observe Remarks 1–8 on page 58.

No. 3. Old Oak Staining with Dull, Weak Gray-Brown Tone

To the prepared surface apply Antique-Oak Brown "L," liquid, exactly as in Formula No. 1, and observe Remarks 1–8 on page 58.

No. 4. Dark Old Oak Staining with Very Gray-Brown Tone

To the prepared surface apply Antique-Oak stain "S," liquid, exactly as in Formula No. 1, and observe Remarks 1–8 on page 58.

No. 5. Oak Staining with Yellowish-Brown Tone

To the prepared surface apply Antique-Oak stain "M," liquid, exactly as in Formula No. 1, and observe Remarks 1–8 on page 58.

Old Oak Imitations with Light-Proof Aniline Dyes (New-Brown Stains)

The New-Brown stains, "A," "B," "C," "D," "E" and "J," which are very fast to light, produce on oak all the various antique tones from light to medium, to dark; according to the amount of dye used per liter of staining solution.

The final tone obtained with the New-Brown stains is absolutely independent of the amount of tannin in the oak, and is due solely to the dyes used.

Because of this quality, the New-Brown stains can be used for staining woods with little or no tannin, and all others. An addition of 50 cu. cm. concentrated ammonia per liter of the ready solution is always advisable with New-Brown stains, as it renders easier their penetration into the pulp of the wood and effects a uniform finish. All New-Brown stains can be mixed together at will for obtaining intermediary tones.

No. 6. Light Smoke Tone

7 grams New-Brown "J." Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use. An addition of 50 cu. cm. ammonia after it has cooled is always an advantage.

Stain the previously-saturated and sandpapered oak furniture with this ammonia solution very wet, allowing sufficient time for its penetration into the wood; then soften with softening-brush or cloth.

With reference to the preparation of oak surfaces, see chapter entitled "Preliminary Treatment of Oak Before Staining," pages 56-57.

No. 6-A. Manufacture of the Same with (Stock Solutions)

140 cu. cm. New-Brown "J," diluted with
860 " " water.

1000 cu. cm. = 1 liter staining solution ready for use after the addition of 50 cu. cm. ammonia.

No. 7. Medium, Yellowish Smoke Tone

30 grams of New-Brown "A." Dissolve in 1 liter boiling water; add 50 cu. cm. ammonia after cooling; filter, and the staining solution is ready for use. Apply as in Formula No. 6.

No. 7-A. Manufacture of the Same with (Stock Solutions)

600 cu. cm. New-Brown "A," diluted with
400 " " water.

1000 cu. cm. = 1 liter staining solution, ready for use after the addition of 50 cu. cm. ammonia.

No. 8. Medium Smoke Tone

20 grams New-Brown "B." Dissolve in 1 liter boiling water, add 50 cu. cm. ammonia after cooling; filter, and the staining solution is ready for use. Apply as in Formula No. 6.

No. 8-A. Manufacture of the Same with (Stock Solutions)

400 cu. cm. New-Brown B," diluted with
600 " " water.

1000 cu. cm. = 1 liter staining solution, ready for use after the addition of 50 cu. cm. ammonia.

No. 9. Medium, Dull Antique-Oak Tone

25 grams New-Brown "D." Dissolve in 1 liter boiling water, add 50 cu. cm. ammonia after cooling; filter, and the staining solution is ready for use. Apply as in Formula No. 6.

No. 9-A. Manufacture of the Same with (Stock Solutions)

500 cu. cm. New-Brown "D" stock solution, diluted with
500 " " water.

1000 cu. cm. = 1 liter staining solution, ready for use after the addition of 50 cu cm. ammonia.

No. 10. Dark, Gray-Brown Antique-Oak Tone

40 grams New-Brown "E." Dissolve in 1 liter boiling water, add 50 cu. cm. ammonia after cooling; filter, and the staining solution is ready for use. Apply as in Formula No. 6.

No. 10-a. Manufacture of the Same with (Stock Solution)

800 cu. cm. New-Brown "E," stock solution, diluted with
200 " " water.

1000 cu. cm. = 1 liter staining solution, ready for use after the addition of 50 cu. cm. ammonia.

Antique Oak Staining of Woods with Prominent Marking, but Containing Little Tannin

Very beautiful and excellent Antique-Oak tones are produced on fir, pine, Carolina pine, pitch-pine, beech, etc., by supplying the lacking tannin with a preliminary application of a tannic acid, such as pyrocatechine or pyrogallic acid; then applying to the surface so grounded the Antique-Oak stain. The final tones are developed in about twelve hours, are light and water-proof, and strongly intensify the natural marking.

No. 11. Tone of Aged Fir or Pine Wood

Ground the well-sandpapered surfaces with a solution of 25 grams pyrocatechine in 1 liter of water; when dry, apply Antique-Oak stain "M," liquid.

No. 12. Yellowish Antique-Oak Tone on Woods with Little Tannin

Ground the well-sandpapered surfaces with a solution of 50 grams pyrogallic acid in 1 liter of water; when dry, sandpaper lightly and apply Antique-Oak stain "M," liquid.

No. 13. Medium, Dull Brown Antique-Oak Tone on Woods with Little Tannin

Ground the well-sandpapered surfaces with a solution of 25 grams pyrogallic acid in 1 liter of water; when dry, sandpaper lightly and apply Antique-Oak stain "K," liquid.

No. 14. Dark Gray-Brown on Woods with Little Tannin

Ground the well-sandpapered surfaces with a solution of 50 grams pyrogallic acid in 1 liter of water; when dry, sandpaper lightly and apply Antique-Oak stain "L," liquid.

Remark I: The solutions of pyrocatechine and pyrogallic acid used for grounding must always be freshly prepared, and cannot be kept long.

Remark II: The grounding with pyrocatechine and pyrogallic acid produces no stain, but a dye is generated by the influence of the Antique-Oak stain on the pulp of the wood. Hence, it may easily happen that in applying the colorless grounding with a brush or sponge, certain parts, especially corners and edges, are poorly or not at all impregnated. After the development of the final tone these neglected places show as white or light spots, and are very hard to remove. Great care should therefore be taken in applying these colorless groundings as well as in softening them; for every irregularity in the distribution of the grounding shows very distinctly in the form of light or dark spots as soon as the stain is developed.

Remark III: A preliminary preparation of coniferous woods with Arti-Equalizer is not admissible in connection with the use of Antique-Oak stains.

Walnut Imitations

Walnut Imitation with Granular Walnut Stain

The stain obtained by boiling down Vandyke-Brown with soda or potash, and long used for walnut imitation, comes in the form of small, irregular, black-brown grains or sticks.

Dissolve 100 to 150 grams Granular Walnut stain in 1 liter of boiling water, filter through a fine-meshed cotton cloth, and apply to the wood as hot as possible.

This stain possesses the quality of being fast to light and air, is exceedingly inexpensive, and may be kept in solution a very long time.

Because of the difficult assimilation of Granular Walnut stain by the hard parts of the wood it is advisable to

dampen fir and pine before staining with a wet sponge, in order to diminish the assimilation of the soft parts; and if ammonia is added to the solution a more uniform tone will result.

On account of their light coloring, the hard annual rings show very distinctly when using this stain.

By going over walnut-stained surfaces with a solution of 25 to 30 grams of potassium chromate the tone becomes somewhat redder, and with a solution of 1 part pyrolignite of iron to 10 parts water, somewhat grayer and duller.

In spite of being light-proof and inexpensive, the Granular Walnut stain is by no means an ideal one, for its solutions always contain a considerable number of floating particles of earth seemingly unremovable by filtering, which smudge the surfaces and clog the pores, giving them a dark appearance. Because of the weak penetrability of granular solutions, furniture stained with them has the disadvantage of lacking permanency; for, after short usage, this finish wears off at the corners and edges, allowing the uncolored wood to show through.

Walnut Imitations with Permanganate of Potassium

Permanganate of potassium comes in the form of black-violet crystals and dissolves in hot water with a reddish-violet color. Its availability for wood-staining rests on its property of depositing in the veins of the wood a good light and air-proof brown residue, occasioned by the simultaneous effect of air and the presence of organic substances (including wood).

Staining with permanganate of potassium is done as follows:

Dissolve 25 to 50 grams permanganate of potassium in 1 liter of hot but not boiling water; let the solution stand about ten minutes, stirring frequently, and then filter.

The solution must be applied to the wood with either a sponge or a woolen cloth, as brush-bristles are immediately destroyed by the strong permanganate.

Freshly-stained wood has a brilliant red-violet appearance at first, but after the dye is deposited in the veins, assumes a walnut-brown tone.

If a very strong dark stain is required, it is necessary to give a second application, as stronger solutions of permanganate of potassium cannot be made on account of its slight solubility. Fir and pine should first be saturated with a wet sponge.

The light to dark walnut-brown stain obtained with permanganate of potassium has the property of being immediately destroyed by mineral acids, especially by strongly deodorizing substances, such as bisulphite of sodium or sulphuric acid.

This fact is put to practical use when stencilling designs on light to dark brown backgrounds in imitation of inlaid work.

Glue stencil to the surface and apply bisulphite of sodium thickened with dextrine to the open design; this process removes the brown stain therefrom. (Bisulphite of sodium is obtainable at any large drug store, either in crystal form or n solution.)

Remove stencil and wash the wood with water; when dry, sandpaper lightly and polish or varnish.

If preferred, the stencil design may be bleached with sulphuric acid (fumes of sulphur).

Saturate the design-portion with a wet sponge; place the article in the fuming-room and burn sulphur therein. In a brief while the fumes destroy or bleach the brown stain from the uncovered parts of the wood, and it is then ready for procedure as above.

Hard, fine-pored woods (maple, birch, cherry, etc.), afford the best ground for such imitation inlaid work, and it is of the utmost importance that the stencil be made to adhere firmly at the edges.

Should the process prove unsuccessful, the fault may be with the bisulphite of sodium, as this salt keeps only a very limited time, and must be in a tightly-closed receptacle in a cool place.

Walnut Imitations with Aniline Dyes

Lighter and darker walnut tones are obtainable with Walnut-Brown stains "R" and "G," soluble in water.

As the designation "walnut brown" means no certain fixed tone, and sometimes gray-brown and sometimes reddish or yellowish dark-brown walnut imitations are desired, it is often necessary to modify somewhat the colors obtained with Walnut-Brown "R" and "G." This is effected by the addition of Nigrosine and New True-Green (both soluble in water), using the stock solutions of the above dyes as described on pages 40 to 44.

No. 15. Walnut Imitation with Walnut-Brown "R"

50 grams Walnut-Brown "R." Dissolve in 1 liter boiling water, add 50 cu. cm. ammonia after cooling; filter, and the staining solution is ready for use.

No. 15-a. Manufacture of the Same with Stock Solutions

Use the stock solution of Walnut-Brown "R," to which has been added 50 cu. cm. ammonia, without thinning.

Remark: Should the tone be too red (which may occur with light tones), add a little New True-Green, or Nigrosine.

No. 16. Walnut Imitations with Walnut-Brown "G"

50 grams Walnut-Brown "G." Dissolve in 1 liter boiling water, add 50 cu. cm. ammonia after cooling; filter, and the staining solution is ready for use.

No. 16-a. Manufacture of the Same with Stock Solutions

Use the pure unthinned stock solution of Walnut-Brown "R," without any thinning.

Remark: Walnut-Brown "G" gives rather yellowish-walnut tones.

Darkening of Natural Walnut Wood

Natural walnut is light or dark in coloring, according to its age and origin, whether it be French, German, Italian or American.

Dark, black-veined walnut is of greater commercial value than the light walnut with less veins showing; therefore to the latter wood it is endeavored to impart, by artificial means, the rich dark coloring of the former.

This can be effected with any of the water-stains described for walnut imitation, but best by Walnut-Brown "R" or "G," previously diluted with water, according to the natural ground-color of the walnut wood.

For heightening the natural walnut tone and imparting a warmer, redder tone, stain with the alcoholic extract of bloodroot and dragon's-blood; or stain the shellac with this extract, as described under mahogany stains.

The same effect is obtainable by staining the first coats of shellac with Mahogany-Brown "H" or "D," (soluble in alcohol).

Rosewood Imitation

Similar to walnut, but more intensive and darker reddish-brown in tone is the precious rosewood, which is best imitated on dark-veined walnut. But as this is nearly as high in price as rosewood, other cheaper woods are used for the imitation of the latter. The simplest method is the use of Rosewood-Brown, soluble in water.

No. 17. Rosewood Imitation

60 grams Rosewood-Brown (soluble in water). Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

Mahogany Imitations

Light walnut sapwood is best fitted for imitating mahogany, as the formation of the pores is nearly the same. Good imitations are also obtained on alder, red beech and cherry.

Mahogany Staining with Mahogany-Brown "H" and "D"

Mahogany-Brown dyes "H" and D" (soluble in water), are recommended for their light-proof qualities, simple requirements of use and the certainty of obtaining a striking mahogany tone.

No. 18. Light Mahogany

20 grams Mahogany-Brown "H." Dissolve in 1 liter boiling water, add 50 cu. cm. ammonia after cooling; filter, and the staining solution is ready for use.

No. 18-a. Manufacture of the Same with Stock Solutions

400 cu. cm. Mahogany-Brown "H," diluted with
600 " " water.

1000 cu. cm. = 1 liter staining solution, ready for use after the addition of 50 cu. cm. ammonia.

No. 19. Dark Mahogany

50 grams Mahogany-Brown "D." Dissolve in 1 liter boiling water, add 50 cu. cm. ammonia after cooling; filter, and the staining solution is ready for use.

No. 19-a. Manufacture of the Same with Stock Solutions

Use the stock solution of Mahogany-Brown "D," to which has been added 50 cu. cm. ammonia, without diluting.

According to its age and origin, the natural mahogany varies in color, being sometimes a light, sometimes a more yellow-brown, and again a dark decided reddish-brown. Likewise, in mahogany imitations there are different

tones, designated respectively as old-mahogany, new-mahogany, rosewood-mahogany, American-mahogany, etc.

Old-mahogany has a very decided red tone.

New-mahogany shows a light, yellowish-brown coloring.

Rosewood-mahogany has a dark, claret tone, and

American-mahogany has a very bright, but deep, claret tone.

To produce these various colorings, Mahogany-Brown "D" is tinged according to requirements, with New-Red or with Persio-Red, or with both simultaneously.

Use the stock solutions described on pages 40 to 44 and make experiments first with a sample of the wood which is to be stained in order to get the correct tone.

As the full beauty of a stain is not wholly apparent until after the shellacking and matting, this should be done with the sample, that the finished result may be seen.

For a full, rich, dark mahogany stain, it is often necessary to color the shellac with Mahogany-Brown "D" or Mahogany-Red (both soluble in alcohol). To produce the popular bluish-red tone in dark mahogany staining, stain the polish with a little Diamond Magenta or Methyl-Violet, (both soluble in alcohol).

For brightening light mahogany imitations use Mahogany-Brown "H," (soluble in alcohol). A ground polish should always be applied first in cases where a supplementary coloring of the natural or previously-stained wood is necessary when polishing, as a regular distribution of the stain by the polishing ball is not possible in any other way.

No. 20. Mahogany Red

65 grams Mahogany-Red. Dissolve in 1 liter boiling water, add 50 cu. cm. ammonia after cooling; filter, and the staining solution is ready for use.

Darkening the Natural Mahogany Wood

Mahogany with a natural coloring of intense red-brown is of far greater value than light, dull-colored mahogany; therefore artificial means are employed to effect in the latter wood a simulation of the rarer and more expensive species, by the use of potassium chromate, bloodroot and dragon's-blood.

A powerful reddish-brown tone, very fast to light, is shortly produced through the influence of the potassium chromate on the natural dye and tannin always present in large quantities in mahogany.

The solution should not contain more than 25 to 30 grams potassium chromate per liter of water, for if used in greater strength a superfluous amount may remain in the wood without combining with the dye and tannin therein, and have a very destructive effect on the shellac or varnish subsequently applied. The latter loses its elasticity, can no longer follow the continual expansion and contraction of the wood, and cracks in a short time.

This destructive effect of the uncombined potassium chromate on shellac, etc., is due to its acetous character and may be prevented by placing furniture so stained in the fuming chamber with gaseous ammonia; or, if more convenient, by washing it with a solution of 1-10 liter ammonia in 1 liter of cold water. The gaseous or liquid ammonia which has penetrated into the wood converts the superfluous potassium chromate into a perfectly harmless salt without influencing the tone of the stain in any way.

In all instances, sodium chromate can be used with exactly the same effect as potassium chromate, but the former has the advantage of being more easily soluble in water and requiring less time to prepare. Even in the manufacture of very concentrated solutions there is absolutely no precipitation of the dissolved salt when the solution cools, such as is often observed on cold winter days with strong solutions of potassium chromate.

The solubility of sodium chromate in water is so high that its solution may be effected in cold water, but it must be kept in closed receptacles and in a dry place, as it easily absorbs moisture from the air and then deliquesces.

To render the natural tone of the mahogany warmer and brighter, stain with an extract of dragon's-blood and bloodroot prepared as follows:

Transfuse 50 grams bloodroot and 50 grams dragon's-blood with 1 liter high per cent. alcohol and let the mixture stand for several days in a warm place. The dye is extracted by the alcohol, which becomes a deep red. Filter and put in bottles for future use.

The same effect may be produced by staining the subsequently applied shellac with Mahogany-Brown "H" or "D," (soluble in alcohol).

Unhealthy Effects of Potassium Chromate Stains

In wool-dyeing establishments, where the use of chromate of potassium and sodium is general, and in other places of their use, it has been observed that young workmen especially, who have had little or no previous contact with potassium chromate stains, are infected with a peculiar disease upon coming into contact with these chemicals. Their hands and arms show painful, ulcerous abscesses, which do not heal, as a rule, until the patient is a long time removed from proximity to the chemicals concerned.

This disease is favored especially by skin defects, cuts, etc., by which the solutions gain penetration.

An antidote for this poisoning is to bathe the hands and arms after contact with a solution of 50 cu. cm. of liquid bisulphite of sodium in 1 liter of cold or lukewarm water. If liquid bisulphite of sodium cannot be obtained, use a solution of 50 grams of solid bisulphite of sodium in 1 liter of water, but add 10 cu. cm. of hydrochloric acid or 5 cu. cm. of sulphuric acid, so that there is a very perceptible odor of the latter.

This preparation immediately converts the poisonous chromic-acid into harmless chrome-green, and abscesses are prevented. The solution of bisulphite of sodium must always be freshly prepared, as it loses its effect after standing.

Older workmen and those accustomed by long usage to these acids are seldom if ever affected, which demonstrates that the human body may, with time, be rendered impervious to certain chemical effects.

Staining of Genuine Mahogany

The harmful and often destructive effect exercised by potassium stains on shellac has been the one disadvantage of their use.

No undesirable element whatsoever is present in the new Ammonia Genuine Mahogany stains "N," "P," "Q" and "R," liquid, which are ideally adapted to all requirements.

In combination with the natural tannin of mahogany and the dye pigments contained therein, they produce reddish to dark red-brown tones of light and water-proof quality, and have no injurious effect on the subsequently applied shellac.

The essentially fine properties of Ammonia Genuine Mahogany stains may be summarized as follows:

1. They have no ill effect on coats of shellac or varnish.
2. They are especially light-proof.
3. They penetrate deeply into the wood.
4. They leave the pores of the mahogany open.
5. Their stains do not rub through.
6. The tones obtained are deeper and more intense than those produced with potassium stains, so that further treatment of the shellac with dyes soluble in alcohol, or with extract of bloodroot, is unnecessary.

As the Genuine Mahogany stains form a dye only with the tannin and dye of genuine mahogany, they are

not to be used for woods similar to mahogany with little tannin, and never with woods containing no tannin.

No. 21. Light Mahogany

Stain mahogany, previously rubbed with oil, with Genuine Mahogany stain "N," liquid, and ready for use, very wet; let it penetrate well into the wood and then soften.

A light reddish-brown tone develops in a few hours.

As with potassium stains, the oiling may be done after the staining.

No. 22. Dark Mahogany

Stain mahogany, previously rubbed with oil, with Genuine Mahogany stain "P," liquid, and ready for use, exactly as described in Formula No. 21.

No. 23. Red Mahogany

Stain mahogany, previously rubbed with oil, with Genuine Mahogany stain "Q," liquid, and ready for use, exactly as described in Formula No. 21.

No. 24. Reddish-Dark Mahogany

Stain mahogany, previously rubbed with oil, with Genuine Mahogany stain "R," liquid, and ready for use, exactly as described in Formula No. 21.

Brown Staining with Light-Proof, Acetous Aniline Dyes in Modern Tones

By the proper combination of a limited number of light-proof acetous aniline dyes, many and varied tones may be produced on woods containing little tannin, such as fir, pine, pitch-pine, Carolina pine, alder, beech, American whitewood, maple, etc., as well as on oak, which is rich in tannin; the lesser or greater amount thereof having no influence on acetous aniline dyes.

In order to stain the surfaces as regularly as possible, very resinous woods, such as pitch-pine and Carolina pine, should have the resin previously removed by the process described on pages 29 to 32.

With woods containing little resin, such as fir, alder, maple, etc., a simple preliminary preparation of the surfaces with Arti-Equalizer as described on pages 25 to 26 is sufficient. Oak wood should always be saturated before staining with a solution of cooking salt. (See "Preliminary Treatment of Oak Before Staining," pages 56 to 57.) For simple and rapid preparation of staining solutions ready for use, employ the proper stock solutions (pages 40 to 44).

a. Staining on Wood Containing Little Tannin

No. 25. Cherry Imitation

3.25 grams New-Orange,
1 gram New-Yellow,
0.75 grams Nigrosine.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 25-a. Manufacture of the Same with (Stock Solutions)

65 cu. cm. New-Orange,
20 " " New-Yellow,
15 " " Nigrosine,
900 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 26. Light, Brilliant, Reddish-Brown

7.25 grams New-Orange,
2 " Nigrosine,
1.25 " Persio-Red.

Dissolve in 1 liter hot water; when cool, filter, and the staining solution is ready for use.

No. 26-A. Manufacture of the Same with (Stock Solutions)

145 cu. cm. New-Orange,
40 " " Nigrosine,
25 " " Persio-Red, diluted with
790 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 27. Powerful Yellow-Brown

30 grams New-Brown "A,"
7.5 " Mahogany-Brown "H."

Dissolve in 1 liter hot water; when cool, filter, and the staining solution is ready for use.

No. 27-A. Manufacture of the Same with (Stock Solutions)

600 cu. cm. New-Brown "A,"
150 " " Mahogany-Brown "H," diluted with
250 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 28. Light, Yellowish Dull-Brown

6.5 grams Nigrosine,
2.5 " True-Yellow "G,"
3.0 " New-Orange.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 28-A. Manufacture of the Same with (Stock Solutions)

130 cu. cm. Nigrosine,
50 " " True-Yellow "G,"
60 " " New-Orange, diluted with
760 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 29. Medium, Reddish, Dull-Brown

30 grams New-Brown "E." Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 29-a. Manufacture of the Same with (Stock Solutions)

600 cu. cm. New-Brown "E," diluted with
400 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 30. Dark Antique-Oak Brown

46 grams New-Brown "D,"
3 " Nigrosine,
1 " Persio-Red.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 30-a. Manufacture of the Same with (Stock Solutions)

920 cu. cm. New-Brown D,"
60 " " Nigrosine,
20 " " Persio-Red,

1000 cu. cm. = 1 liter staining solution ready for use.

No. 31. Light, Dull, Red-Brown

5.5 grams New True-Green,
1.25 " Persio-Red,
0.5 " Mahogany-Brown "H."

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 31-a. Manufacture of the Same with (Stock Solutions)

110 cu. cm. True-Green,
25 " " Persio-Red,
10 " " Mahogany-Red, diluted with
855 " " water,

1000 cu. cm. = 1 liter staining solution ready for use.

No. 32. Medium Violet-Brown

5 grams Walnut-Brown "R,"
2 " Persio-Red,
8 " Nigrosine.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 32-a. Manufacture of the Same with (Stock Solutions)

100 cu. cm. Walnut-Brown "R,"
40 " " Persio-Red,
160 " " Nigrosine, diluted with
700 " " water.

1000 cu. cm. = 1 liter staining solution for ready use.

No. 33. Rich Red-Brown

30 grams Walnut-Brown "R,"
15 " Nigrosine,
5 " Mahogany-Brown "D."

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 33-a. Manufacture of the Same with (Stock Solutions)

600 cu. cm. Walnut-Brown "R,"
300 " " Nigrosine,
100 " " Mahogany-Brown "D,"

1000 cu. cm. = 1 liter staining solution ready for use.

No. 34. Rich, Dark Brown

30 grams Walnut-Brown "R,"
10 " Nigrosine,
10 " New True-Green.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 34-a. Manufacture of the Same with (Stock Solutions)

600 cu. cm. Walnut-Brown "R,"
200 " " Nigrosine,
200 " " New True-Green,

1000 cu. cm. = 1 liter staining solution ready for use.

No. 35. Light Mode Brown

7.5 grams Nigrosine,
1.5 " New-Orange,
1.0 " True-Yellow "G."

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 35-a. Manufacture of the Same with (Stock Solutions)

150 cu. cm. Nigrosine,
30 " " New-Orange,
20 " " True-Yellow "G," diluted with
800 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 36. Modern Gray-Brown

20 grams New Gray-Brown "F." Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 36-a. Manufacture of the Same with (Stock Solutions)

400 cu. cm. New Gray-Brown "F," diluted with
600 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

b. Staining on Oak Wood

No. 37. Tone of Oiled, Naturally-Polished Oak

10 grams Oak-stain "H" (light). Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 37-A. Manufacture of the Same with (Stock Solutions)

200 cu. cm. Oak-Stain "H" (stock solution), diluted with
800 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 38. Light, Dull Yellow-Brown

6 grams New-Brown "J,"
2 " New-Orange.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 38-A. Manufacture of the Same with (Stock Solutions)

120 cu. cm. New-Brown "J,"
40 " " New-Orange, diluted with
840 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 39. Medium, Bright Yellow-Brown

10 grams Walnut-Brown "G,"
5 " New-Yellow,
5 " New-Orange.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 39-A. Manufacture of the Same with (Stock Solutions)

200 cu. cm. Walnut-Brown "G" (stock solution),
100 " " New-Yellow (stock solution), and
100 " " New-Orange, diluted with
600 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 40. Light, Yellowish Mode Brown

2 grams Nigrosine,
1.5 " True-Yellow "G,"
1.5 " New-Orange.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 40-a. Manufacture of the Same with (Stock Solutions)

40 cu. cm.	Nigrosine,
30 " "	True-Yellow "G,"
30 " "	New-Orange, diluted with
900 " "	water.
1000 cu. cm.	= 1 liter staining solution ready for use.

No. 41. Medium Bronze Brown

15 grams New-Brown "B,"
5 " New-Brown "C."

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 41-a. Manufacture of the Same with (Stock Solutions)

300 cu. cm.	New-Brown "B,"
100 " "	New-Brown "C," diluted with
600 " "	water.
1000 cu. cm.	= 1 liter staining solution ready for use.

No. 42. Light, Reddish Mode Brown

8 grams Nigrosine,
1 gram True-Yellow "G,"
3.5 grams New-Orange.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 42-a. Manufacture of the Same with (Stock Solutions)

160 cu. cm.	Nigrosine,
20 " "	True-Yellow "G,"
70 " "	New-Orange, diluted with
750 " "	water.
1000 cu. cm.	= 1 liter staining solution ready for use.

No. 43. Light, Reddish Gray-Brown

4 grams New Gray-Brown "G,"
4 " New-Brown "C."

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 43-a. Manufacture of the Same with (Stock Solutions)

80 cu. cm. New Gray-Brown,
80 " " New-Brown "C," diluted with
840 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 44. Rich Reddish-Brown

50 grams New-Brown "G." Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 44-a. Manufacture of the Same with (Stock Solutions)

Use the pure, undiluted stock solution of Walnut-Brown "G."

Anthracene Stains

All the various shades of modern dull-brown tones can be produced on oak wood with the new Anthracene stains.

Anthracene stains possess special qualities which render them particularly applicable to oak, and also to woods containing little tannin, viz.:

1. They penetrate deeply into the wood, being hardly inferior to Antique-Oak stains in this respect, and are more fast to light and air than the latter.
2. They produce a uniform tone, very dull and beautiful, the intensity of which is not lessened by age.
3. Final tones are developed within a few hours and are not affected by the amount of tannin in the oak.
4. The pores are of one tone with the surface if the oak has been previously treated with ammonia water.

5. Solutions of Anthracene stains, ready for use, can be kept a long time without any deterioration in quality.
6. All Anthracene stains may be mixed at will to obtain intermediary tones.
7. The solutions may be made highly concentrated (stock solutions—100 grams dissolved in 1 liter of water), and for medium and light tones may be previously diluted with cold water and perhaps a little ammonia.

METHOD OF MAKING SOLUTIONS OF ANTHRACENE STAINS

This process differs somewhat from the usual method. The procedure is as follows:

Combine 1 liter of boiling water with 25 cu. cm. concentrated ammonia and then pour in slowly the Anthracene stain to be dissolved, stirring constantly. After the solution has cooled, add 25 to 50 cu. cm. ammonia per liter of staining solution, filter, and it is ready for use. If desired, it may be kept in well-closed receptacles for later use.

NOTE: If the Anthracene stain is dissolved in the usual manner by simply pouring in boiling water, a thick foam is formed, which is difficult to disperse, and which has an undesirable effect upon the staining.

c. Anthracene Stains on Oak

No. 45. STRONG MEDIUM-BROWN ON OAK

50 grams Anthracene-Brown "ED." Dissolve in 1 liter boiling ammonia water; after cooling, add 50 cu. cm. concentrated ammonia, filter, and the staining solution is ready for use. (For method of dissolving, see page 82.)

No. 45-A. MANUFACTURE OF THE SAME WITH (STOCK SOLUTIONS)

500 cu. cm. Anthracene-Brown "RD" (stock solution), (100 grams per liter), diluted with
500 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 46. Medium Reddish-Brown on Oak

50 grams Anthracene-Brown "2R." Dissolve in 1 liter boiling ammonia water; after cooling, add 50 cu. cm. concentrated ammonia, filter, and the staining solution is ready for use. (For method of dissolving, see page 82.)

No. 46-a. Manufacture of the Same with (Stock Solutions)

350 cu. cm. Anthracene-Brown "G" (stock solution), (100 grams per liter), diluted with
650 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 47. Rich Yellow-Brown on Oak

35 grams Anthracene-Brown "G." Dissolve in 1 liter boiling ammonia water; after cooling add 50 cu. cm. concentrated ammonia, filter, and the staining solution is ready for use. (For method of dissolving, see page 82.)

No. 47-a. Manufacture of the Same with (Stock Solutions)

350 cu. cm. Anthracene-Brown "G" (stock solution), (100 grams per liter), diluted with
650 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 48. Medium, Dull-Brown on Oak

35 grams Anthracene-Brown "GR." Dissolve in 1 liter boiling ammonia water; after cooling, add 50 cu. cm. concentrated ammonia, filter, and the staining solution is ready for use. (For method of dissolving, see page 82.)

No. 48-a. Manufacture of the Same with (Stock Solutions)

350 cu. cm. Anthracene-Brown "GR" (stock solution), (100 grams per liter), diluted with
650 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 49. Medium, Yellowish Dull-Brown on Oak

35 grams Anthracene-Brown "2G." Dissolve in 1 liter boiling ammonia water; after cooling, add 50 cu. cm. concentrated ammonia, filter, and the staining solution is ready for use. (For method of dissolving, see page 82.)

No. 49-a. Manufacture of the Same with (Stock Solutions)

350 cu. cm. Anthracene-Brown "2G" (stock solution), (100 grams per liter), diluted with
650 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 50. Medium, Reddish Dull-Brown on Oak

30 grams Anthracene Dull-Brown "R." Dissolve in 1 liter boiling ammonia water; after cooling, add 50 cu. cm. concentrated ammonia, filter, and the staining solution is ready for use. (For method of dissolving, see page 82.)

No. 50-a. Manufacture of the Same with (Stock Solutions)

300 cu. cm. Anthracene Dull-Brown "R" (stock solution), (100 grams per liter), diluted with
700 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 51. Quite Dark, Rich Red-Brown on Oak

100 grams Anthracene Red-Brown. Dissolve in 1 liter boiling ammonia water; after cooling, add 50 cu. cm. concentrated ammonia water, filter, and the staining solution is ready for use. (For method of dissolving, see page 82.)

No. 51-a. Manufacture of the Same with (Stock Solutions)

Use the pure, undiluted stock solution of Anthracene Red-Brown, (100 grams per liter).

No. 52. Gray Antique-Brown on Oak

30 grams Anthracene Dull-Brown "D." Dissolve in 1 liter boiling ammonia water; after cooling, add 50 cu. cm.

concentrated ammonia, filter, and the staining solution is ready for use. (For method of dissolving, see page 82.)

No. 52-a. Manufacture of the Same with (Stock Solutions)

300 cu. cm. Anthracene Dull-Brown "D" (stock solution), (100 grams per liter), diluted with
700 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 53. Dark Brown on Oak

100 grams Anthracene Dark-Brown. Dissolve in 1 liter boiling ammonia water; after cooling, add 50 cu. cm. concentrated ammonia, filter, and the staining solution is ready for use. (For method of dissolving, see page 82.)

No. 53-a. Manufacture of the Same with (Stock Solutions)

Use the pure, undiluted stock solution of Anthracene Dark-Brown, (100 grams per liter).

No. 54. Dark, Yellowish Dull-Brown on Oak

50 grams Anthracene Bronze-Brown. Dissolve in 1 liter boiling ammonia water; after cooling, add 50 cu. cm. concentrated ammonia, filter, and the staining solution is ready for use. (For method of dissolving, see page 82.)

No. 54-a. Manufacture of the Same with (Stock Solutions)

500 cu. cm. Anthracene Bronze-Brown (stock solution), (100 grams per liter), diluted with
500 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

d. Anthracene Stains for Woods Containing Little Tannin

No. 55. Rich, Dull Reddish-Brown

50 grams Anthracene-Brown "RD." Dissolve in 1 liter boiling ammonia water; after cooling, add 50 cu. cm. ammonia; filter, and the staining solution is ready for use. (For method of dissolving, see page 82.)

No. 55-A. Manufacture of the Same with (Stock Solutions)

500 cu. cm. Anthracene-Brown "RD" (stock solution), (100 grams per liter), diluted with
500 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 56. Medium, Vivid Reddish-Brown

40 grams Anthracene-Brown "2R." Dissolve in 1 liter boiling ammonia water; after cooling, add 50 cu. cm. ammonia; filter, and the staining solution is ready for use. (For method of dissolving, see page 82.)

No. 56-A. Manufacture of the Same with (Stock Solutions)

400 cu. cm. Anthracene-Brown "2R" (stock solution), (100 grams per liter), diluted with
600 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 57. Medium, Dull-Brown

30 grams Anthracene-Brown "GR." Dissolve in 1 liter boiling ammonia water; after cooling, add 50 cu. cm. ammonia, filter, and the staining solution is ready for use. (For method of dissolving, see page 82.)

No. 57-A. Manufacture of the Same with (Stock Solutions)

300 cu. cm. Anthracene-Brown "GR" (stock solution), (100 grams per liter), diluted with
700 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 58. Medium, Dull Yellowish-Brown

25 grams Anthracene-Brown "2G." Dissolve in 1 liter boiling ammonia water; after cooling, add 25 cu. cm. ammonia, filter, and the staining solution is ready for use. (For method of dissolving, see page 82.)

No. 58-A. Manufacture of the Same with (Stock Solutions)

250 cu. cm. Anthracene-Brown "2G" (stock solution), (100 grams per liter of water), diluted with
750 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 59. Powerful, Dull-Brown

40 grams Anthracene Bronze-Brown. Dissolve in 1 liter boiling ammonia water; after cooling, add 25 cu. cm. ammonia, filter, and the staining solution is ready for use. (For method of dissolving, see page 82.)

No. 59-A. Manufacture of the Same with (Stock Solutions)

400 cu. cm. Anthracene Bronze-Brown (stock solution), (100 grams per liter), diluted with
600 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 60. Medium Brown

20 grams Anthracene Dark-Brown. Dissolve in 1 liter boiling ammonia water; after cooling, add 25 cu. cm. ammonia, filter, and the staining solution is ready for use. For method of dissolving, see page 82.)

No. 60-A. Manufacture of the Same with (Stock Solutions)

200 cu. cm. Anthracene Dark-Brown (stock solution), (100 grams per liter), diluted with
800 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

These sixteen formulas depict the possibilities of Anthracene stains, and it is easily perceivable that, by proper variation in the admixture and dilution thereof, a wide range of modern brown tones is obtainable.

e. Special-Oak Stains, Liquid, and Ready for Use

Special-Oak Stains I to XVII are intended for those who prefer a liquid stain ready for use. They are sold in highly concentrated form to save all possible expense of

packing and freight, and for medium and light tones can be diluted with one to seven parts water.

When diluting same, in addition to the requisite cold water, add 25 to 50 cu. cm. concentrated ammonia per liter of staining solution.

Special-Oak stains are to be regarded as combined stains, for they contain both dyes and chemicals; hence the final tone obtained is almost entirely independent of the amount of tannin in the wood. All Special-Oak stains can be mixed with each other at will, and also combined with acetous aniline dyes for obtaining intermediary tones.

Directions for Using the Special Oak Stains

To the prepared oak surface, apply the staining solution very wet (in concentrated form, or properly diluted with cold water); after it has penetrated well into the wood, soften with softening-brush. When dry, rub surfaces lightly with fine sandpaper and matt in the usual manner. Special-Oak stains are also fitted for all other kinds of wood.

Formulas

No. 61. Light, Very Yellowish-Brown

125 cu. cm.	Special-Oak Stain "I," double concentrated, diluted with
825 " "	cold water and
50 " "	concentrated ammonia added.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 62. Medium, Yellow-Brown

250 cu. cm.	Special-Oak Stain "II," double concentrated, diluted with
700 " "	cold water and
50 " "	ammonia added.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 63. Powerful, Reddish-Brown

500 cu. cm. Special-Oak Stain "IV," double concentrated, diluted with
500 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 64. Rich, Dark Brown

Stain with Special-Oak Stain "V," double concentrated, without diluting.

No. 65. Powerful, Dull Antique-Oak Brown

500 cu. cm. Special-Oak Stain "VI," double concentrated, diluted with
500 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 66. Lighter Gray-Brown

250 cu. cm. Special-Oak Stain "IX," double concentrated, diluted with
700 " " cold water and
50 " " concentrated ammonia added.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 67. Light Smoke-Brown

125 cu. cm. Special-Oak Stain "X," double concentrated, diluted with
825 " " cold water and
50 " " concentrated ammonia added.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 68. Medium, Dull Antique-Brown

250 cu. cm. Special-Oak Stain "XIII," double concentrated, diluted with
700 " " cold water and
50 " " concentrated ammonia added.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 69. Very Rich, Vivid Red-Brown

Stain with Special-Oak Stain "XIV," double concentrated, without diluting.

No. 70. Black-Brown

Stain with Special-Oak Stain "XV," double concentrated, without diluting.

Ebony Wood Imitations

The simplest and surest process of staining wood black is by means of Nigrosine "T," in particles soluble in water, and Carbon-Black Stain "Z," liquid.

A. Black Staining with Nigrosine "T," Soluble in Water

Dissolve 100 grams Nigrosine "T" in 1 liter boiling water; filter, and stain the wood very wet. To effect a sufficiently strong black, a second application may be necessary, but this should always be given on a thoroughly dry surface.

B. Black Staining with Carbon Black Stain "Z," Liquid

This liquid preparation, commercially ready for use, gives a good covering black with only one coat, applied very wet.

Owing to its self-contained shellac, Carbon-Black Stain "Z" lessens the deep penetration into the wood of

shellac subsequently applied, thus affording a highly-polished surface in a minimum time. The solution can be kept for a long period.

Intensifying the Black Stain

In whatever manner the wood may be stained black, the subsequent application of shellac should contain an addition of Nigrosine or Lac-Black (soluble in alcohol), if a beautiful, rich and polished black surface is desired.

For this purpose dissolve 30 grams Nigrosine or Lac-Black in 1 liter 95-96% alcohol, filter, and add to the shellac, according to need; or put some of the pulverized Nigrosine or Lac-Black on the damp polishing ball, wrap a linen cloth around it and polish in the usual manner. The dye, being dissolved by the polish from the ball, is strained through the linen cloth, and dyes the wood.

For blue-black use Nigrosine, but for deep-black use Lac-Black to color the shellac.

If the articles stained black are to be waxed, add to the molten wax a proper quantity of Olesole-Black "B" for blue-black, or Olesole-Black "BG" for deep-black, and stir until the entire mass is of uniform tone. Apply the wax with a cloth; let it stand a day and brush with a medium-stiff brush until there is a dull polish.

Should the surfaces be treated with a matting preparation, e. g., Arti-Matt, it will give them greater hardness and the power of resistance to soap and water.

Staining Wood Gray

In the manufacture of gray stains there are three individual cases to be considered:

1. If such woods as oak, pear, elm and chestnut are to be stained, the operation is very simple, because these woods already contain an ingredient, viz., the tannin—for obtaining the various gray shadings. Hence, after sandpapering, it is only necessary to stain with a weak or strong solution of green vitriol

in water. A light or dark gray, respectively, is gradually developed, assisted by the oxygen of the air.

2. If the wood contains little or no tannin, as is the case with fir, pine, maple, etc., it is necessary to effect it artificially by applying a solution of tannin in water; when dry, stain with a solution of green vitriol.
3. Woods containing no tannin can be stained with acetous aniline dyes, light-proof, which have the advantage of giving the desired stain after only one coat. By the proper admixture of Blue-Gray, Orange, Yellow and Green, all conceivable gray shades are obtainable.

Gray Staining of Woods Containing Tannin by Means of Green Vitriol

The depth of the gray stain produced by Green Vitriol is dependent upon the quantity of tannin contained in the wood and the strength of the vitriol solution used.

As oak is very rich in tannin, by weakening or strengthening the solution, all tones from light to dark can be obtained.

But with ash and pear, a very strong solution produces only a medium gray, and on maple, which contains but little tannin, the very strongest solution will give only a very light, delicate gray; for the amount of gray dye produced in the wood is limited by the quantity of tannin contained therein.

Light, Yellowish-Gray on Oak

Stain the well-sandpapered wood with a cold solution of 5 grams Green Vitriol in 1 liter of water. Let the stained articles be exposed freely to the air for a day.

Medium Gray on Oak

Stain the oak with a cold solution of 15 grams Green Vitriol in 1 liter of water and leave to the influence of the air for one or two days.

Rich Gray on Oak

Stain with a cold solution of 15 grams Green Vitriol in 1 liter of water and subject the stained objects two or three days to the oxidizing effect of the air.

This must be done in vitriol-staining all woods containing tannin, as the final tone cannot be determined until after several days of oxidizing.

In one and the same kind of wood, the amount of tannin contained differs proportionately according to the age and origin of the wood; therefore it is necessary to make preliminary tests with vitriol solutions of different strengths in order to determine which will obtain the desired result.

If the solution used is of such strength that the desired tone develops within a few hours, great disappointment will be experienced when a considerably darker shade becomes apparent after several days, due to oxidization and the influence of the tannin upon the stain.

In judging all gray stains produced by Green Vitriol, it must be taken into consideration that the bright bluish-gray tone obtained after twenty-four to forty-eight hours is not final, but becomes constantly darker and finally a dull, yellowish gray.

Remark: Should the gray staining with Green Vitriol on wood containing tannin come out too dark or irregular, it can be remedied by applying a solution of 50 grams oxalic acid (saccharic acid) in 1 liter of hot water. Then wash the surfaces with water to remove the oxalic acid from the wood, after which they can be restained with aniline dyes according to the following formulas.

Do not attempt to stain again with Green Vitriol, as it is impossible to remove all the oxalic acid from the wood; therefore regular staining with Green Vitriol is prevented.

Gray Staining of Woods Containing Little Tannin by Means of Green Vitriol

To give woods with little tannin the amount necessary for staining gray with Green Vitriol, apply first a weak or strong solution of tannin in water; then stain with a

solution of Green Vitriol in water, sufficient to give the desired tone.

The gray stain develops gradually by the oxidizing effect of the air. It shows first as a bright bluish-gray, and becomes a dull gray after two or three days.

The solutions of tannin and of Green Vitriol must always be freshly prepared, as they spoil after a few days even when kept in closed receptacles.

Stains thus obtained are very fast to light and air, but still the color gradually darkens and becomes considerably yellower and dead.

In general these methods are best for medium and dark grays. For lighter tones they are too uncertain, and therefore not to be recommended.

Formulas

Dark Gray on Woods Containing Little Tannin

Saturate the wood with a hot solution of 50 grams tannin in 1 liter of water; when dry, apply a solution of 40 grams Green Vitriol in 1 liter of water.

The stain develops to its full depth after two days.

Medium Gray on Woods Containing Little Tannin

Saturate the wood with a hot solution of 30 grams tannin in 1 liter of water; when dry, apply a solution of 20 grams Green Vitriol in 1 liter of water. The stain develops to its full depth after two days.

Remark: The use of solutions of Green Vitriol stronger than 40 grams per liter may give very unfavorable results later, when the objects stained are put to actual use.

Although they give very light-proof colors, stains with Green Vitriol have the following disadvantages which restrict their use:

1. Light to dark tones are easily produced by these formulas, but it is almost impossible to obtain an exact previously-described tone; therefore the use

of dyes is necessary, as described in chapter, "Gray Stains with Aniline Dyes."

2. The final tone is uncertain and is influenced too much by the kind of wood, the amount of tannin contained and the purity of the tannin and Green Vitriol used.
3. Its great disadvantage lies in darkening and becoming duller and yellower if the objects stained with it have been already waxed and matted.

Accordingly many cabinet-makers have discarded this process despite its advantages in favor of the one about to be described.

Gray Stains with Aniline Dyes and Combined Stains

The aniline dyes of the acetous group are best for producing light, medium and dark tones on woods containing little tannin, such as fir, pine, maple, alder, etc.

Chief among them is Nigrosine, soluble in water, which can be shaded up or down with True-Yellow "G," Indol Blue-Green, New-Orange, and for very blue-gray, with Induline "W." These shading dyes render possible all tones of yellowish-gray, greenish-gray, reddish-gray and blue-gray.

For staining oak the new Anthracene-Gray and liquid Special-Oak Stain "XI" have proven very excellent, as they penetrate the large and deep-lying pores of the oak much better than pure aniline dyes.

Any shade can be obtained by the use of Anthracene-Gray and Special-Oak Stain "XI" in combination with the above acetous aniline dyes.

For waxing, shellacking and matting of gray stains always use bleached wax and shellac and colorless matting (Arti-Matt White), as the tones are changed too much by yellow-colored preparations, and an ugly, yellowish reflex results.

No. 71. Silver Gray on Maple or other Light Woods

10 grams Silver-Gray. Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 71-a. Manufacture of the Same with (Stock Solutions)

200 cu. cm. Silver Gray, diluted with
800 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 72. Light, Yellowish-Gray on Light-Colored Woods

5 grams Nigrosine "T." Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 72-a. Manufacture of the Same with (Stock Solutions)

100 cu. cm. Nigrosine "T," diluted with
900 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 73. Medium, Brownish-Gray on Woods Containing Little Tannin

15 grams New Gray-Brown "G." Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 73-a. Manufacture of the Same with (Stock Solutions)

300 cu. cm. New Gray-Brown "G," diluted with
700 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 74. Dove-Gray

15 grams Nigrosine,
4 " Induline "W,"
1 gram Indol-Blue.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 74-a. Manufacture of the Same with (Stock Solutions)

300 cu. cm. Nigrosine,
80 " " Induline "W,"
20 " " Indol-Blue, diluted with
600 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 75. Dark Gray

48.5 grams Nigrosine and
1.5 " Indol Blue-Green.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 75-a. Manufacture of the Same with (Stock Solutions)

970 cu. cm. Nigrosine, and
40 " " Indol Blue-Green,

1000 cu. cm. = 1 liter staining solution ready for use.

No. 76. Dark Slate Blue-Green on Oak

36 grams Induline "W,"
10 " Nigrosine, and
4 " Indol Blue-Green.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 76-a. Manufacture of the Same with (Stock Solutions)

720 cu. cm. Induline "W,"
200 " " Nigrosine,
80 " " Indol Blue-Green,

1000 cu. cm. = 1 liter staining solution ready for use.

No. 77. Light, Yellowish-Gray on Oak

Dissolve 10 grams Anthracene-Gray in 1 liter boiling ammonia water; when cool, filter, and the staining solution is ready for use.

For dissolving Anthracene stains, see page 82.

No. 77-A. Manufacture of the Same with (Stock Solutions)

100 cu. cm. Anthracene-Gray (100 grams per liter), diluted with
900 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 78. Powerful, Medium-Gray on Oak

Dissolve 30 grams Anthracene-Gray in 1 liter boiling ammonia water; when cool, filter, and the staining solution is ready for use.

For dissolving Anthracene Stains, see page 82.

No. 78-A. Manufacture of the Same with (Stock Solutions)

300 cu. cm. Anthracene-Gray (100 grams per liter), diluted with
700 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 79. Lighter, Brownish-Gray on Oak

300 cu. cm. Special-Oak Stain "XI," double concentrated, liquid, diluted with
700 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 80. Swamp-Oak Gray

500 cu. cm. Special-Oak Stain "XI," double concentrated, liquid, diluted with
500 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 81. Light, Blue-Gray on Oak

6 grams Induline "W,"
0.5 gram Persio-Red.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 81-a. Manufacture of the Same with (Stock Solutions)

120 cu. cm. Induline "W,"
10 " " Persio-Red, diluted with
870 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 82. Metallic Luster Stain. Light, Yellowish-Gray on Oak with (Stock Solutions)

A. 100 cu. cm. Nigrosine,
3 " " True-Yellow "G,"
3 " " New-Orange, diluted with
694 " " water.

800 cu. cm.

B. Dissolve by rubbing 15 to 30 grams Aluminum-Bronze (10,000 fine), with 200 cu. cm. solution of gum (70 grams gum-arabic dissolved in 130 cu. cm. hot water). Now combine staining solution "A" with the pasty Aluminum-Bronze "B," pour the mixture into a bottle which can be corked, and shake until both are completely mixed. The staining solution is now ready for use.

Stain the previously-sandpapered oak surface with this solution and soften with a large brush. Brush the still moist surfaces with a soft brush or rub with a woolen cloth. This distributes the Aluminum-Bronze evenly, and the entire surface has a shining metallized appearance. Articles so stained should then be waxed and treated with a colorless matting (Arti-Matt, white).

The Metallic-Luster solutions can be kept a long time. They should be shaken vigorously each time before using, as a part of the aluminum settles to the bottom after standing.

The formulas given above should be sufficient to enable any one to imitate any desired tone after a few experiments.

In effecting light gray tones, the result is considerably influenced by the natural color of the wood, therefore all experiments should be made upon a piece of the same wood to be treated; for one and the same solution may give a light, yellowish, reddish or quite dark tone, according to the natural color of the wood.

Of course the changes due to subsequent shellacking, matting or waxing must be taken into consideration in determining the stain.

REMARK: All stains with Induline "W" show a reddish-bronze tone after drying. This completely disappears immediately after shellacking or waxing.

Staining Wood Red

The animal and vegetable dyes, such as dye-wood, sandalwood and cochineal, formerly used for producing red stains, find little application to-day, as the certainty of their results do not meet all requirements.

In modern manufacture of various mahogany-red, Bordeaux-red and rose-colored stains, the brilliant and simple acetous aniline dyes are used almost exclusively; and of these dyes, New-Red and Persio-Red have proven best, owing to their easy solubility and light-proof qualities.

To deaden and shade these brilliant red dyes, use Nigrosine, Induline "W" and New True-Green. By a proper mixture of the above dyes, or their stock solutions, any desired red can be produced upon wood.

Formulas

No. 83. Rich Crimson

40 grams New-Red. Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 83-a. Manufacture of the Same with (Stock Solutions)

800 cu. cm. New-Red, diluted with
200 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 84. Dark Bordeaux

30 grams New-Red,
10 " New True-Green,
10 " Nigrosine.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 84-a. Manufacture of the Same with (Stock Solutions)

600 cu. cm. New-Red,
200 " " New True-Green,
200 " " Nigrosine.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 85. Amaranth Wood Imitation

46.5 grams Persio-Red,
1 gram Nigrosine,
2.5 grams New True-Green.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 85-a. Manufacture of the Same with (Stock Solutions)

930 cu. cm. Persio-Red,
20 " " Nigrosine, and
50 " " New True-Green.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 86. Bright Bordeaux-Red

40 grams Persio-Red. Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 86-a. Manufacture of the Same with (Stock Solutions)

800 cu. cm. Persio-Red, diluted with
200 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 87. Brick-Red

11 grams New-Red,
9 " New True-Green.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 87-a. Manufacture of the Same with (Stock Solutions)

220 cu. cm. New-Red,
180 " " New True-Green, diluted with
600 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 88. Dark-Red

40 grams Walnut-Brown "R,"
30 " Mahogany-Red.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

Yellow and Orange Stains

In the manufacture of yellow and orange stains, light-proof acetous aniline dyes are almost exclusively employed, as natural dyes (yellow-wood, flavine, etc.) are bothersome to use and do not compare in light-proof quality with the former.

The ground-colors for all yellow and orange stains are New-Yellow and New-Orange. To shade and deaden these very brilliant colors, Nigrosine is used in proportionate quantities.

Formulas

No. 89. Candle-Wood Imitations

2.5 grams New-Yellow,
3 " New-Orange,
0.5 " Nigrosine.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 89-a. Manufacture of the Same with (Stock Solutions)

50 cu. cm. New-Yellow,
60 " " New-Orange, and
10 " " Nigrosine, diluted with
880 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 90. Leather-Yellow

1.25 grams New-Yellow,
2.50 " New-Orange,
1.25 " Nigrosine.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 90-a. Manufacture of the Same with (Stock Solutions)

25 cu. cm. New-Yellow,
50 " " New-Orange,
25 " " Nigrosine, diluted with
900 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

Green and Olive-Green Stains

Light-proof green and olive stains are obtained only with dyes of the acetous group, of which New True-Green and Indol Blue-Green best apply to this special purpose. New True-Green gives brilliant, yellowish-green tones and is used in combination with the likewise light-proof dyes, New-Yellow, New-Orange, Nigrosine and Induline "W," Nigrosine and New True-Green.

Special-Oak Stain "XII," double concentrated, liquid, and Anthracene Serpentine-Green Stain, pulverized, are best for staining oak, because of their penetration into the pores. These stains can be mixed at will with the aniline dyes.

For simple and rapid manufacture of stains for the various green and olive tones, use the stock solutions of the dyes just mentioned, as explained on pages 40-44.

Formulas

No. 91. Rich, Brilliant, Blue-Green

50 grams Indol Blue-Green. Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 91-a. Manufacture of the Same with (Stock Solutions)

Use the pure, undiluted stock solution of Indol Blue-Green.

No. 92. Rich, Brilliant, Yellowish-Green

50 grams New True-Green. Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 92-a. Manufacture of the Same with (Stock Solutions)

Use the pure, undiluted stock solution of New True-Green.

No. 93. Dark, Olive-Green

40 grams New True-Green,
3 " New-Orange,
7 " Nigrosine.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 93-a. Manufacture of the Same wiht (Stock Solutions)

800 cu. cm. New True-Green,
60 " " New-Orange,
140 " " Nigrosine.

1000 cu. cm. = 1 liter staining solution, ready for use.

No. 94. Medium-Olive

20 grams New True-Green,
4 " New-Orange,
6 " Nigrosine.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 94-A. Manufacture of the Same with (Stock Solutions)

400 cu. cm. New True-Green,
80 " " New-Orange,
120 " " Nigrosine, diluted with
400 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 95. Black-Green

40 grams New True-Green,
30 " Indol Blue-Green,
30 " Nigrosine.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 95-A. Manufacture of the Same with (Stock Solutions)

400 cu. cm. New True-Green,
300 " " Indol Blue-Green,
300 " " Nigrosine,

1000 cu. cm. = 1 liter staining solution ready for use.

No. 96. Medium Gray-Green

10 grams New True-Green,
10 " Induline "W."

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 96-A. Manufacture of the Same with (Stock Solutions)

200 cu. cm. New True-Green,
200 " " Induline "W," diluted with
600 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 97. Medium Green-Olive on Oak

250 cu. cm. Special-Oak Stain "XII," double concentrated, diluted with
750 " " cold water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 98. Rich, Dark-Gray on Oak

Stain oak with undiluted Special-Oak Stain "XII," double concentrated.

No. 99. Medium Serpentine-Green on Oak

20 grams Anthracene Serpentine-Green dissolved in 1 liter boiling ammonia water; after cooling, mix with 50 cu. cm. concentrated ammonia; filter, and the staining solution is ready for use.

For method of dissolving Anthracene Stains see page 82.

No. 100. Dark Gray-Green on Oak

80 grams Anthracene Serpentine-Green dissolved in 1 liter boiling ammonia water; after cooling, add 50 cu. cm. ammonia, filter, and the staining solution is ready for use.

For method of dissolving Anthracene Stains see page 82.

For all green and olive stains only bleached shellac and color less matting (Arti-Matt, White) should be used.

Blue and Violet Stains

The acetous dyes producing blue and violet stains are: Azine-Blue, Indol-Blue, Induline "W," Azine-Violet and Persio-Red. Azine-Blue gives brilliant greenish-blue tones, very fast to light, and is mixed with Azine-Violet to obtain pure blue and reddish-blue stains.

For dull blue on wood, Induline "W" combined with Indol-Blue is the best, as Azine-Blue (although possessing the greatest fastness to light of all blue dyes) has the disadvantage of not penetrating deeply into the wood, and for particular tones does not give a uniform stain.

Azine-Violet gives brilliant blue-violet stains, highly light-proof, being in this respect much superior to all other violet dyes.

All dull blue-violet and red-violet tones are obtainable with a proper combination of Induline "W" and Persio-Red and are very fast to light.

Induline "W" alone or in combination with Indol-Blue is used for all dark blue stains.

For easy and handy manufacture of blue and violet stains, use the stock solution described on pages 40-44.

REMARK: As Azine-Blue has very little power to penetrate into the wood when in cold solution, it should be made as hot as possible, applied only with a sponge, and then wiped off with the sponge squeezed out.

Formulas

No. 101. Medium, Bright Greenish-Blue

40 grams Azine-Blue. Dissolve in boiling water as free as possible from lime (condensed water, or water a long time boiled); when cool, filter, and the staining solution is ready for use.

Apply as hot as possible with a sponge; then wipe off with the sponge squeezed out.

No. 101-a. Manufacture of the Same with (Stock Solutions)

800 cu. cm. Azine-Blue, diluted with
200 " " boiling water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 102. Medium, Dull-Blue

13 grams Induline "W,"
2 " Indol-Blue.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 102-a. Manufacture of the Same with (Stock Solutions)

260 cu. cm. Induline "W," and
40 " " Indol-Blue, diluted with
700 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 103. Dark Blue

43 grams Induline "W,"
7 " Indol-Blue.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 103-a. Manufacture of the Same with (Stock Solutions)

860 cu. cm. Induline "W,"
140 " " Indol-Blue.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 104. Medium, Dull Red-Violet

6 grams Induline "W,"
6 " Persio-Red.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 104-a. Manufacture of the Same with (Stock Solutions)

120 cu. cm. Induline "W,"
120 " " Persio-Red, diluted with
760 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

No. 105. Amaranth-Violet

20 grams Persio-Red,
10 " Nigrosine.

Dissolve in 1 liter boiling water; when cool, filter, and the staining solution is ready for use.

No. 105-a. Manufacture of the Same with (Stock Solutions)

400 cu. cm. Persio-Red,
200 " " Nigrosine, diluted with
400 " " water.

1000 cu. cm. = 1 liter staining solution ready for use.

Remark: All blue and violet stains in which Induline "W," Azine-Blue and Azine-Violet are used, when dry show a reddish-bronze tone with light and medium shades, but this disappears after subsequent shellacking, matting or waxing.

In the shellacking, varnishing or matting of bright blue and violet-stained surfaces, use only bleached and colorless preparations, as those of yellowish tone will turn the original color to green.

A slight change in the original tone is, however, unavoidable, no matter what conditions prevail, for all blue stains become greener and all violet colors somewhat bluer.

These changes must be taken into consideration in judging the color beforehand.

Water-Proof and Washable Wood Stains

(Oxidine Stains)

Famous architects in interior construction have come to the author with the request that he evolve and publish some means of staining domestic woods so that they would be practically water-proof without the use of coats of protecting varnish. The only former requirement in wood-staining was fastness to light,—the property of being washable or proof to water not coming into question, as the coat of solid varnish protected sufficiently the stained articles from the soap and water with which they were washed.

Modern architects sought to avoid the necessity of this varnish application, for they reasoned rightly that even a light coat was injurious and destroyed the ideal beauty of the wood.

The author thereupon began to test the tones obtained by various methods of staining for their fastness to water. His results showed that only a comparative few met the requirements, and that in order to make possible a greater selection of water-proof colors it would be necessary to work out new staining formulas.

The experiments were successful in so far as affording a rich choice of modern brown and gray-brown tones, but it was not possible to get bright colors in a large number. Therefore selection must needs be made from the already-

known and the newly-evolved formulas, in order to produce stains which will most nearly effect the desired color tones.

If water or soap is spattered on a stained surface and dries in a spot, the result is the same as on a pane of glass or a mirror,—the dust gathered at the place of the water-drop and the dissolved soap remain after the water has evaporated. Spots are easily removable from stained surfaces with a slightly-damp cloth, but this cannot be done with soap and water spots on waxed and matted surfaces.

The formulas for "water-proof and washable wood-stains" have won highest commendation and are successfully employed in many of the largest furniture factories.

Their practical value lies not only in the fact that the colors obtained are water-proof and washable, but the tones in themselves are of exceeding beauty. Excellent results are obtained even on beech, which is very hard to stain properly, thus making possible its satisfactory substitution for the much more expensive oak wood, etc.

Furniture stained with these oxidine stains may be treated in the usual manner with shellac or matting, but no varnish is necessary, although if desired a very light coat may be applied.

General Remarks Concerning Water-Proof and Washable Wood Stains

If our modern living-rooms are to be stained without the usual subsequent application of shellac, matting or wax, the stain must be water-proof in order that occasional cleansings with wet cloths or weak soapsuds will not fade noticeably or change the original tone. But this is not the only requirement. It must be proof against the destructive effect of light and air, and able to withstand the rubbing and knocking of ordinary usage without wearing through at the corners and edges.

As a result of these strict requirements, stains previously used for this purpose are no longer practicable.

In the manufacture of stains, only such formulas can be used as will produce a dye insoluble in soap or water when two or more chemicals are subsequently employed; this must lodge in the cells of the wood, producing a certain designated tone.

These formulas therefore embody purely chemical processes, and are based on the capacity of a number of chemicals to form a colored, insoluble precipitate (dye).

The procedure with formulas dependent upon the precipitation of one or more chemicals is as follows:

Put in solution the chemical to be used, then stain the wood (previously well sandpapered) in the usual manner. When the surfaces so grounded are perfectly dry, apply the second stain—the developing stain—for precipitating the chemical already in the wood. This developing stain may be in gaseous form (fuming with gaseous ammonia), or may be applied to the grounded surface in the usual liquid form. The precipitation results either at once or gradually, in the course of several hours to one day, according to the nature of the chemical used.

General Rules for the Use of Precipitate Stains

1. Apply the grounding stain with brush, sponge or woolen cloth, very wet, so that the upper layers of the wood are saturated with the solution.
2. Allow sufficient time for thorough penetration, and do not begin to soften too soon,—an error likely to occur with very wet-stained surfaces.
3. Now remove with a sponge or woolen cloth all superfluous stain which has not been absorbed by the wood.

   If the stain was applied with a brush, nevertheless use a sponge or cloth to soften it in preference to the softening-brush, which has less absorbability, and is more difficult to rid of the fluid taken up by it, in order to repeat the process.

If a fresh sponge or cloth is used for this purpose, dip it in the staining solution and squeeze dry; for if softened in water, the first few strokes may wash off the dye from the surface, making its subsequent fixing of lighter tone.

If superfluous stain is not removed from the surface, it dries, depositing chemical particles thereon, which in connection with the subsequently-applied developing stain, form a colored precipitate detrimental to the desired effect. Such a condition is remediable only by careful sandpapering.

4. The developing stains should not be applied until the grounding stain is absolutely dry. In employing the liquid form thereof, omit sandpapering and apply the developing stain with the same care as the grounding stain itself.
5. Before placing articles in the fuming-room, sandpaper gently; the grain is not raised by the fuming process.
6. As most staining solutions have very little apparent color, extreme care should be taken that no corners or edges are left unstained; for such places show as white spots after the application of the developing stain and are difficult to remedy.
7. Colorless or very weakly-colored grounding stains must be applied with the utmost care and regularity, as failure in this respect will mar later results.
8. All brushes, sponges, cloths and receptacles used in staining or for keeping the solutions, must be carefully cleansed, so that the contents will not be contaminated by intermingling.
9. The remains of stains which have been used should never be poured back into the receptacles, lest through contact with tannin or other chemicals they have become impure.

All the general rules set forth in this book must be observed in using precipitate stains.

If articles so stained are not to be varnished, sandpaper gently, and then brush with a bristle brush to heighten the surface polish.

If varnish is desired, a very thin coat will suffice, as the stain in itself is resistant to water, soap and scouring.

Advantages of Precipitate Stains

1. Precipitate Stains are water-proof and do not require varnishing.
2. They are fast to light and air, being made from metallic salts.
3. They effect dull, beautiful tones, filling all requirements of modern good taste.
4. They penetrate very deeply into the wood and intensify strongly its natural marking.
5. Precipitate Stains give good results on all woods, and a uniform stain can be produced even on beech, (especially with the Precipitate Fumed Stains). Therefore it is possible to use this wood much more than formerly, both for furniture and interior finish.
6. If articles are to be matted, a very light coat of varnish is sufficient.
7. Furniture stained with oxidine stains is not visited by the wood-worm on account of the astringent odor of the metallic oxide deposited in the wood.

REMARK: If soap or water spots occur on unvarnished surfaces, they are easily removed with a damp cloth.

The author deems it no disadvantage that the grain is slightly raised in the cleansing process, as the original polish may be restored by brushing with a bristle brush.

The formulas for these water-proof and washable stains have been classified under three groupings to facilitate comprehensive knowledge thereof.

Precipitate Fumed Stains

In the same manner that oak is fumed to produce an antique tone thereon, it is possible to stain all woods by applying metallic salts and subjecting to the fuming process, which fixes the hydroxides as colored precipitates, insoluble in water.

In the fuming of oak, the tone varies in proportion to the quantity of tannin contained in the wood; but in stains produced by the effect of gaseous ammonia on metallic salts, the shading and depth of tone are determined respectively by the kind of salts used and the amount thereof deposited in the wood by the grounding stain.

Therefore, the latter process enables one to dependably effect the final tone by a proper choice of the metallic salts and the concentration or dilution of its solution used as grounding stain. The quantity of tannin is, however, also to be considered, as it combines with the metallic salts of the grounding stain and forms tannic metal oxides.

This is the only reason why woods containing tannin come out darker when staining than woods without same. If dark tones are desired on woods containing little tannin, such as fir, maple, willow, etc., the requisite amount must be instilled artificially by a preliminary staining with a solution of 10 to 30 grams pyrogallic acid per liter of water before the application of the grounding stain. If, on the other hand, it is desired to give a light tone to woods containing tannin, the grounding stain (metallic salts solution) must be diluted with water before using.

Should the stain come out too light, or for any reason be desired darker, apply to the fumed surfaces a proportionately strong solution of pyrogallic acid (5 to 20 grams per liter), so that the tannin metal oxide gradually forms and again fumes the article.

If oak with uneven amounts of tannin has been stained, apply to the light places a solution of 5 to 10 grams

pyrogallic acid and then fume again; this will remove the irregularities.

If very powerful tones are desired on woods containing but little tannin, the following method is advisable: Ground with the proper solution of metallic salts one board previously stained with a solution of 10 grams, one with 20 grams, one with 30 grams pyrogallic acid, and one board not so stained; then fume all together. This experiment will show how much tannin is lacking.

The various solutions of metallic salts (oxidine stains), used for grounding can be mixed at will for obtaining intermediary tones.

After articles are stained they may be sandpapered or given a dull polish with a brush.

Furniture already in use, which has had the grain raised by washing or rubbing, can likewise be given its original polish in the same manner.

Formulas

No. 106. Medium, Yellowish Dull-Brown on Oak

With a sponge or woolen cloth, stain the prepared sandpapered surfaces very wet with undiluted

OXIDINE NICKEL STAIN, LIQUID.

Allow sufficient time for its thorough penetration, then wipe the still wet surface with a well-squeezed sponge or staining cloth, squeezing frequently to rid it of the superfluous stain absorbed.

Let the objects stand at ordinary temperature for one day to dry; then sandpaper gently and place in the fuming room. (For small articles an air-tight wooden chest can be satisfactorily used.)

On the floor place one or more saucers filled with commercial, concentrated ammonia (spirits of sal ammoniac), close tightly all windows and doors and leave the grounded

objects twelve to twenty-four hours to the influence of the ammonia fumes.

By the influence of gaseous ammonia on the Oxidine Nickel Stain a light to medium, very subdued dull-brown tone (according to the amount of tannin) is gradually developed in the upper layers of the wood, and at the same time its marking is greatly intensified. Stains so obtained are water-proof and washable, and light-proof to a very high degree.

If oak is stained too light, apply to the light places a solution of 10 to 15 grams pyrogallic acid, and then fume again.

No. 107. Very Light Yellowish Dull-Brown on Woods Containing Little Tannin

Stain these woods as described in Formula No. 106, with undiluted

OXIDINE NICKEL STAIN, LIQUID,

and fume twelve to twenty-four hours with gaseous ammonia.

If desired by this process to produce on woods containing little tannin the same tone as on alder (containing medium amount of tannin), or on woods containing a medium amount of tannin, the same dark tone as on oak (large amount of tannin),—before applying the grounding-stain use a solution of 10 to 15 grams pyrogallic acid in 1 liter of water.

But, on the other hand, if desired to obtain on woods containing little tannin the depth of tone used on oak (No. 106), before grounding with Oxidine Nickel Stain, apply a solution of 30 grams pyrogallic acid in 1 liter of water.

The solution of pyrogallic acid must always be freshly prepared.

The Oxidine Stain must not be applied until the pyrogallic acid is dry.

No. 108. Medium, Reddish Dull-Brown on Oak

Stain the previously well-sandpapered objects with undiluted Oxidine Cobalt Stain, liquid, as in Formula No. 106; fume after they have dried twelve to twenty-four hours.

All data and explanation in Formula No. 106 are equally applicable here.

No. 109. Medium, Reddish Dull-Brown on Woods Containing Little Tannin

Ground these woods with a solution of 10 grams pyrogallic acid per liter of water; when dry, apply undiluted Oxidine Cobalt Stain, liquid, as described in Formula No. 106; dry, and fume twelve to twenty-four hours with gaseous ammonia.

No. 110. Light, Reddish Dull-Brown on Woods Containing Little Tannin

Stain these woods with undiluted

OXIDINE COBALT STAIN, LIQUID,

as described in Formula No. 106, and fume the stained and dried objects twelve to twenty-four hours with gaseous ammonia, after they have been sandpapered.

No. 111. Medium, Gray Olive-Brown on Oak

Stain the sandpapered objects with a solution of ½ liter Oxidine Copper Chloride Stain "Z," liquid, diluted with ½ liter water, as described in Formula No. 106, and fume the so grounded objects after drying twelve to twenty-four hours.

All data and explanation in Formula No. 106 are equally applicable here.

Remark: In all stains in which Oxidine Copper-Chloride Stain "Z" alone or mixed with other oxide stains is used, the tone obtained by fuming becomes more and more brown for a week, as the ammonia in the wood evaporates. This does not happen if the furniture is matted immediately.

Special care should be taken with Oxidine Copper-Chloride Stain "Z" to wipe the surface off dry, for if the superfluous stain dries there, a patina-like greenish deposit is left during the fuming; this not only injures the structure of the wood, but it is very difficult to remove.

No. 112. Medium, Gray Olive-Brown on Woods Containing Little Tannin

Ground these woods with a solution of 10 grams pyrogallic acid per liter of water; when dry, apply a solution of ½ liter Oxidine Copper Chloride Stain "Z," liquid, diluted with ½ liter of water; sandpaper after drying, and fume twelve to twenty-four hours with gaseous ammonia, as described in Formula No. 106.

No. 113. Lighter, Greenish-Gray on Woods Containing Little Tannin

Stain these woods, as described in Formula No. 106, with a solution consisting of ½ liter Oxidine Copper Chloride Stain "Z," liquid, diluted with ½ liter water; sandpaper after drying and fume twelve to twenty-four hours with gaseous ammonia. (See remark at Formula No. 111.)

No. 114. Medium, Dull Light-Brown on Oak

Stain previously-sandpapered objects with pure, undiluted

OXIDINE CHROME STAIN "K," LIQUID,

as described in Formula No. 106; when dry, sandpaper, and fume twelve to twenty-four hours.

All data and explanation in Formula No. 106 are equally applicable here.

No. 115. Light, Dull-Brown on Woods Containing Little Tannin

Ground these woods with a solution of 10 grams pyrogallic acid in 1 liter of water; coat after drying with undiluted

OXIDINE CHROME STAIN "K," LIQUID;

when dry, sandpaper, and fume twelve to twenty-four hours with gaseous ammonia.

No. 116. Lighter, Dull-Yellow on Woods Containing Little Tannin

Stain these woods, as described in Formula No. 106, with pure, undiluted

OXIDINE CHROME STAIN "K," LIQUID;

when dry, sandpaper, and fume twelve to twenty-four hours with gaseous ammonia.

No. 117. Medium Dull-Brown on Oak

Stain objects sandpapered in the usual manner with pure, undiluted

OXIDINE CHROME STAIN "C," LIQUID,

as described in Formula No. 106; when dry, sandpaper, and fume twelve to twenty-four hours.

All data and explanation in Formula No. 106 are equally applicable here.

No. 118. Medium Bice-Brown in Woods Containing Little Tannin

Ground these woods with a solution of 10 grams pyrogallic acid in 1 liter of water; when dry, stain with undiluted

OXIDINE CHROME STAIN "C," LIQUID;

when dry, sandpaper, and fume twelve to twenty-four hours with gaseous ammonia.

No. 119. Quite Light, Delicate Bice Color on Woods Containing Little Tannin

Stain these woods with undiluted

OXIDINE CHROME STAIN "C," LIQUID,

as described in Formula No. 106; when dry, sandpaper, and fume twelve to twenty-four hours with gaseous ammonia.

No. 120. Medium, Dull-Brown on All Kinds of Wood

Ground the previously-sandpapered wood with a freshly-prepared solution of 50 grams of pyrogallic acid in 1 liter water; dry, sandpaper, and fume twenty-four hours.

All data and explanation in Formula No. 106 are equally applicable here.

No. 121. Dark, Gray-Brown on Oak

Stain the sandpapered objects with pure, undiluted

OXIDINE IRON MORDANT, LIQUID,

as described in Formula No. 106; when dry, sandpaper, and fume twelve to twenty-four hours with gaseous ammonia.

All data and explanation in Formula No. 106 are equally applicable here.

No. 122. Medium, Gray-Brown on Woods Containing Little Tannin

Ground these woods with a solution of 10 grams pyrogallic acid in 1 liter of water; coat after drying with undiluted

OXIDINE IRON MORDANT, LIQUID;

when dry, sandpaper, and fume twelve to twenty-four hours with gaseous ammonia.

No. 123. Medium, Rust-Brown on Woods Containing Little Tannin

Stain these woods with undiluted

OXIDINE IRON MORDANT, LIQUID,

as described in Formula No. 106; when dry, sandpaper, and fume twelve to twenty-four hours with gaseous ammonia.

No. 124. Dark Brown on All Kinds of Wood

Ground the sandpapered wood with a freshly-prepared solution of 50 grams pyrogallic acid in 1 liter water; when

dry, apply ½ liter Oxidine Copper Chloride Stain "Z," liquid, diluted with ½ liter water, taking great care that all superfluous stain is wiped off with a well-squeezed staining sponge. Sandpaper after drying and fume twelve to twenty-four hours.

All data and explanation in Formula No. 106 are equally applicable here.

No. 125. Black-Brown on All Kinds of Wood

Ground the previously-sandpapered objects with a freshly-prepared solution of 50 grams pyrogallic acid in 1 liter water; when dry apply 350 cu. cm. Oxidine Iron Mordant, liquid, diluted with 650 cu. cm. water. Let the objects dry freely for one day, during which time a dark gray tone develops; then fume twenty-four hours.

All data and explanation in Formula No. 106 are equally applicable here.

Precipitate Stains Whose Final Tone is Obtained by Successive Staining with Aqueous Solutions of Two Appropriate Chemicals

If a wood surface is stained with the aqueous solution of an appropriate chemical and the superfluous stain removed with a well-squeezed sponge, the gradual evaporation of water serving as a solvent deposits the dissolved chemical substance between the cells in the outer layers of the wood while it is drying.

If a wood surface is stained with the aqueous solution of a chemical producing a colored precipitate or dye (insoluble in water), it is likewise deposited between the cells, giving a characteristic coloring whose tone is dependent upon the chemicals used and their effect upon each other.

Thus the upper layers of the wood are dyed to the depth to which the staining solutions have penetrated. As the dye produced in this manner is insoluble in water and

in weak solutions of soap-suds, the stained surfaces are water-proof and washable. They are also light-proof to a very high degree.

No. 126. Powerful Red-Brown on All Kinds of Wood

75 grams Catechine "3R" boiled one-quarter of an hour in 1 liter of water. Filter and add water again until there is 1 liter.

Stain the well-sandpapered objects with this solution, removing all superfluous stain with a well-squeezed sponge or staining cloth; after drying, coat the surfaces so grounded with Antique-Oak Stain "K," liquid. The final reddish-brown tone is developed in a few hours.

When dry, sandpaper or brush gently in order to give a dull polish.

These objects are now washable, water and light-proof, and can be put to practical use without any coat of varnish; but if desired, they may be shellacked or matted.

No. 127. Powerful, Reddish Dark-Brown on All Kinds of Wood

Ground the wood with a decoction of 75 grams Catechine "NS," as described in Formula No. 126, and coat after drying with Antique-Oak Stain "L," liquid. The final dark brown tone is developed in a few hours.

No. 128. Medium Dull-Brown on All Kinds of Wood

Stain the previously sandpapered wood with a solution of 50 grams pyrogallic acid in 1 liter of hot water; when dry, apply a solution of 50 grams Potassium Chromate in 1 liter of hot water. The final dull brown tone is developed in a short time.

All data and explanation in Formula No. 126 are equally applicable here.

No. 129. Greenish-Blue on All Kinds of Wood

Ground the sandpapered objects with a solution of 500 cu. cm. Oxidine Ferrocyanide Stain, liquid, diluted

with 500 cu. cm. water; remove superfluity with staining sponge well squeezed. After drying, apply a solution of ¼ liter Oxidine Iron Mordant, liquid, diluted with ¾ liter water. The final dull blue tone is produced almost immediately.

All data and explanation in Formula No. 126 are equally applicable here.

REMARK: Should the stain result too light, repeat the above process, grounding again with Oxidine Ferrocyanide and applying Oxidine Iron Mordant.

Sulphamine Stains

Sulphamine has the property of forming a dye in combination with various metallic salts, giving a yellow, brown, red or green color (according to the metallic salt used), which is absolutely insoluble in water, and therefore water-proof and resistant to weak solutions of soapsuds.

Stains made with Sulphamine and Oxidine Copper Chloride Stain "Z" are especially light-proof, while the yellow and green stains made with Sulphamine and Oxidine Nickel Stain, and with Sulphamine and Pyrolignite of Iron are light-proof to a lesser degree.

By a proper combination of Sulphamine and two different metallic salts, in varying ratios, the several intermediary tones can be produced. If the Sulphamine were mixed with only one of the metallic salts mentioned above, the stain, which should not form until it is in the wood, would assemble in the solution, thus making a body color, absolutely unavailable for staining, which would not penetrate into the wood.

In order to prevent this, add an appropriate volatile acid, preferably formic acid, to the Sulphamine solution, and do not add the metallic salt solution until the preparation has cooled completely.

By staining with this solution (Sulphamine formic acid and the proper metallic salt), there is gradually de-

veloped in the wood as the volatile formic acid evaporates, a dye which is produced in twenty-four to forty-eight hours, as the case may be.

This new Sulphamine Metallic Oxide Stain is deposited in the upper layers of the wood as far as it penetrates, and gives it a characteristic water-proof and washable stain.

No. 130. Rich, very Yellowish, Light-Brown

60 grams Sulphamine dissolved in 1 liter hot (not boiling) water and then filtered. Add 25 cu. cm. formic acid, and after it has completely cooled add 120 cu. cm. Oxidine Nickel Stain, liquid.

The staining solution is now ready for use and should be applied very wet with a sponge or woolen cloth to the previously-sandpapered wood.

Allow sufficient time for its thorough penetration; then remove the superfluous stain with a well-squeezed sponge or cloth.

Let articles so stained stand for two hours; then stain again exactly as before. Now let stand two days, during which time the formic acid completely evaporates and the final tone is developed.

They should now be gently sandpapered or brushed, and may be put to practical use without any coat of varnish; but if desired, may be matted or polished.

For lighter tones, dilute the staining solution with cold water and then stain twice, as above.

For darker tones, stain a third time, after an interval of about two hours.

Remarks: The solutions of Sulphamine Stains should always be applied cold.

A second application of the stain after an interval of about two hours is always to be recommended.

To hasten the development of the final tone, put the stained articles in a warm room, thus hastening the evaporation of the formic acid.

Solutions should always be freshly made; they may be kept a maximum of two to three days in bottles or stone jars in a cool place, care being taken that the receptacles are well closed and that tight-fitting cork stoppers are used.

No. 131. Powerful, Yellow-Brown on All Kinds of Wood

60 grams Sulphamine dissolved in 1 liter hot (not boiling) water and then filtered. Add 25 cu. cm. formic acid, and after this has cooled completely, add 60 cu. cm. Oxidine Copper Chloride Stain "Z," liquid.

The solution is now ready for use. Stain the previously-sandpapered wood at intervals of about two hours and let the articles stand two days, during which time the final tone is developed.

All data and explanation given in Formula No. 130 are equally applicable here.

No. 132. Mahogany-Red for All Kinds of Wood

60 grams Sulphamine dissolved in 1 liter hot (not boiling) water and then filtered. Add 25 cu. cm. formic acid, and after this has completely cooled add 120 cu. cm. Oxidine Cobalt Stain, liquid.

The solution is now ready for use. Stain the previously-sandpapered wood at intervals of about two hours, and let stand for two days. During this time the final reddish tone is developed.

All data and explanation given in Formula No. 130 are equally applicable here.

No. 133. Dull, Yellowish-Green for Woods Containing Little Tannin

60 grams Sulphamine dissolved in 1 liter hot (not boiling) water and then filtered. Add 25 cu. cm. formic acid, and after this has completely cooled add 40 cu. cm. pyrolignite of iron.

The solution is now ready for use. Stain twice, leaving a two-hours' interval, and let stand two days for the final development of the tone.

All data and explanation given in Formula No. 130 are equally applicable here.

Black for All Kinds of Wood

An absolutely water-proof, washable and light-proof black is obtained by staining with an aniline stain (not aniline dye).

Aniline salt has the property of combining with copper and chrome salts and forming an absolutely acid-proof and light-proof black in the pulp of the wood, which is practically indestructible.

Dissolve 300 grams aniline salt in 1 liter hot water and add 20 cu. cm. Copper-Chloride Stain "Z."

Stain the wood with this solution while it is still hot; when dry, apply a solution of 50 grams sodium chromate in 1 liter of water; again dry in a very warm room, preferably near a stove.

The coloring, a bright yellow-orange at the start, gradually turns to a dark green and finally into black.

If the stain is not powerful enough, the entire process must be repeated.

To intensify the black tone, rub the dry surfaces with a woolen cloth and linseed oil and let dry for two days. Linseed oil is a powerful conveyer of oxygen. It takes it from the air and adds it to the aniline salt stain, making it much stronger.

Aniline salt stains must always be freshly prepared, because in long standing the formation of black takes place in the solution before it is applied to the wood.

B. Turpentine Stains and Turpentine Wax Stains

Turpentine stains are solutions of aniline (Olesole) dyes, soluble in oil or turpentine.

Turpentine-wax stains are the same, but they contain more or less beeswax, which is also dissolved in the turpentine.

Turpentine and turpentine-wax stains possess two properties of important worth to cabinet-makers:

1. They do not raise the grain of the wood, thus rendering supplementary sandpapering unnecessary. (With supplementary sandpapering there is always more or less danger that the stain will be rubbed through unless the work is very carefully done.)
2. They penetrate the wood very slowly, thus insuring a uniformity of tone, especially on large surfaces.

These are, however, offset by a great disadvantage,—their slight capacity of resistance to light and air. This is a decided disqualification, inasmuch as no method of prevention is known; for there are no dyes combining the properties of perfect solubility in turpentine and fastness to light,—the last an essential requisite of all wood stains because of the long periods of usage given wooden objects and fittings.

Of turpentine stains, those made with Olesole Black "B," Olesole Black "BG" and Olesole Blue are the most light-proof.

Complaints relative to fading of stained furniture will continue as long as turpentine and turpentine-wax stains are used.

The higher cost of turpentine stains (due to the high price of the turpentine itself) as compared to that of water-stains is a further disadvantage.

(a) Turpentine Stains

Turpentine stains are easily prepared. Place the proper amount of Olesole dye in a receptacle containing turpentine; put the receptacle in a pan of hot water and stir constantly until the dye is dissolved; then filter through a thin-meshed cotton cloth. Turpentine should not be heated over an open flame, on account of combustibility.

Formulas

No. 134. Oak-Brown

Dissolve 10 grams Olesole Oak-Brown in 1 liter hot turpentine; filter, and the solution is ready for use.

No. 135. Dark Oak-Brown

Dissolve 20 grams Olesole Antique-Oak Brown in 1 liter hot turpentine; filter, and the solution is ready for use.

No. 136. Walnut-Brown

Dissolve 40 grams Olesole Walnut-Brown in 1 liter hot turpentine; filter, and the solution is ready for use.

No. 137. Light Mahogany-Brown

Dissolve 30 grams Olesole Magohany-Brown "H" in 1 liter hot turpentine; filter, and the solution is ready for use.

No. 138. Dark Mahogany

Dissolve 50 grams Olesole Mahogany-Brown "D" in 1 liter hot turpentine; filter, and the solution is ready for use.

No. 139. Mahogany-Red

25 grams Olesole Mahogany-Brown "D" and 25 grams Olesole Red, dissolved in 1 liter warmed turpentine; filter, and the solution is ready for use.

No. 140. Bright-Red

Dissolve 60 grams Olesole Red in 1 liter hot turpentine; filter, and the solution is ready for use.

No. 141. Dull-Orange

Dissolve 30 grams Olesole Orange in 1 liter hot turpentine; filter, and the solution is ready for use.

No. 142. Bright-Yellow

Dissolve 40 grams Olesole Yellow in 1 liter hot turpentine; filter, and the solution is ready for use.

No. 143. Green

Dissolve 40 grams Olesole Green in 1 liter hot turpentine; filter, and the solution is ready for use.

No. 144. Medium, Dull-Blue

Dissolve 15 grams Olesole Blue in 1 liter hot turpentine; filter, and the solution is ready for use.

No. 145. Gray

Dissolve 10 grams Olesole Black "B" in 1 liter hot turpentine; filter, and the solution is ready for use.

When dry, articles stained with turpentine stains often assume a greenish-bronze tone which disappears immediately after treating with shellac, wax or matting.

(b) Turpentine-Wax Stains

Add 75 to 150 grams molten beeswax to the still hot solutions of Formulas Nos. 134 to 145, and mix well together; this will give turpentine-wax stains immediately ready for use.

Used bleached beeswax for light and bright colors, and yellow wax for dark tones, especially browns.

Turpentine-wax stains deposit a thin coating of wax on the surface when staining, thus avoiding bronzing; and a dull polish may be given by brushing the dry surface.

They possess less penetrability than pure turpentine stains, and in cold weather should always be heated before using in order to liquify the wax.

All Olesole colors are sold in the shape of small, irregular particles.

Remark: To clean vessels which have contained turpentine or turpentine-wax stains, use a warm solution of calcined (pulverized) soda and soap in water; then rinse with pure hot water.

C Alcohol Stains

Alcohol stains, with the exception of the black stains (Nigrosine and Lac-Black), are not very fast to light, and though expensive, do not effect uniform tones; therefore their use for wood-staining proper is not to be commended. The cabinet-maker should consider them as auxiliary stains only, to darken or otherwise alter surfaces stained with water-stains or natural-colored woods. They may also be used to color shellac, lacs and mattings.

In the manufacture of these stains, aniline dyes of the basic group are used exclusively, as they alone possess the easy solubility in alcohol which is required.

They are as follows:

Mahogany-Brown "H,"	soluble in alcohol,	(light mahogany)
Mahogany-Brown "D,"	" " "	(dark mahogany)
Mahogany-Red,	" " "	
Walnut-Brown,	" " "	
Oak-Brown,	" " "	
Antique-Oak Brown,	" " "	
Polish-Yellow,	" " "	(tone of unbleached polish)
Chrysoidine,	" " "	(orange)
Oriole-Yellow,	" " "	(greenish-yellow)
Safranine,	" " "	(bright red)
True-Rose,	" " "	(bright rose)
Methyl-Violet "2B,"	" " "	(bright violet)
Methyl-Violet "R,"	" " "	(bright red-violet)
Blue "R,"	" " "	(pure blue)
Brilliant Chrystal Green,	" " "	(bluish-green)
Silver-Gray,	" " "	(blue-gray)
Brilliant Nigrosine,	" " "	(blue-black)
Lac-Black,	" " "	(deep black)
Induline,	" " "	(dark blue)

To make the solutions:

Transfuse 5 to 30 grams of the above dye with 1 liter high per cent. alcohol (85 to 97%), stirring constantly, or dissolve cold and boil gently three to five minutes. Let cool, filter through cotton or filter-paper, and keep in closed receptacles for subsequent use. Filtering is abso-

lutely necessary for alcohol stains, as nearly all dyes have small particles which are insoluble and must be removed.

It is of the utmost importance that the alcohol be high per cent., for dyes are very difficult to dissolve in the adulterated product, and a considerable precipitate remains.

Because of the high combustibility of alcohol, solutions containing it should not be heated over an open flame, but indirectly, by immersing the receptacle in boiling water.

Light, medium and dark tones can be obtained by proper admixture, concentration or dilution of the staining solutions with high per cent. alcohol.

In staining wood with alcohol-stains, the method of procedure is the same as with water-stains. The former, however, raise the grain less and are absorbed more quickly and in greater quantities by the pulp of the wood than the latter.

Alcohol-stains should be applied cold and very regularly, as subsequent softening has little effect on account of the quick penetration into the wood.

Surfaces stained with alcohol-stains have a greenish-bronze tone after drying, especially with powerful colors, but this disappears completely after the subsequent application of shellac, varnish, wax or matting.

The solution of the above dyes (soluble in alcohol) may be kept an indefinite period.

Formulas

The formulas of alcohol-stains are included in the following chapter. In place of the shellac or alcohol varnish mentioned there, always use the same quantity of 95 to 97% alcohol for dissolving the dye.

The Staining of Shellacs, Mattings and Alcohol Varnishes with Aniline Stains (Alcohol Stains) Soluble in Alcohol

This method is frequently employed in order to enliven the coloring of wood already stained or to effect a shade or depth of tone not always attainable with water-stains alone.

Coloring the shellac invariably accompanies black staining, for it is almost impossible to produce a deep, beautiful and lustrous black by staining only.

To color shellac and alcohol varnishes for black staining (ebony-wood imitations) use exclusively:

Nigrosine for blue-black and Lac-Black for deep black.

When shellacking, matting and varnishing articles stained brown, and natural-colored precious woods, such as mahogany and walnut, stain the preparation to be used with a slight quantity of aniline stain in order to impart a warmer, brighter and richer tone. The following basic dyes are best fitted for brown stains:

Mahogany-Brown "H" and "D," soluble in alcohol.
Mahogany-Red, " " "
Walnut-Brown, " " "
Oak-Brown, " " "
Antique-Oak Brown, " " "
Chrysoidine, " " "

For red, blue, violet, green, olive and gray staining the basic dyes used for alcohol stains can be used. The coloring of shellac or simpler preparations, consists merely of dipping the damp polishing ball in a dish containing pulverized dye and then wrapping a linen cloth over it.

The shellac, penetrating the polishing ball, dissolves the dye (which is gradually strained through the linen cloth during use), and thus stains the wood.

Except with black, this should not be done until after the ground polishing, else the surfaces may be stained irregularly.

As aniline dyes, with the exception of blacks, are not very fast to light, this method of color-polishing is not greatly to be recommended; nevertheless there is no objection to its use for enlivening and brightening natural-colored woods or those stained with water-stains. When the small amount of dye so used has faded, the water-stain or the natural color of the wood still remains, and the change is not very noticeable.

For staining alcohol varnishes proceed as follows:

1. Dissolve 20 to 30 grams of the proper aniline dye in 1 liter of high per cent. alcohol (95 to 97%); when dissolved, filter through a fine-meshed cotton cloth and add this solution according to need to the colorless alcohol varnish or matting until it possesses the desired color.

It is very important that only high per cent. alcohol be used, as most dyes are hard to dissolve in alcohol diluted with water, not to mention the fact that the water causes the varnish to lose its luster and makes it difficult to work.

2. Usually the aniline dye is added directly to the varnish and there dissolved.

The varnish is ready for use after being filtered through paper or felt. This is absolutely necessary, as no dye is soluble without leaving an insoluble precipitate. These insoluble particles cause spots, rendering impossible a lustrous, mirror-like surface.

Every cabinet-maker who places any stress upon good work should treat objects thus shellacked, matted or varnished with another coat of the same uncolored; for all the basic dyes soluble in alcohol which are used (with the exception of the blacks) are also soluble in water. Thus, objects which have no such protecting coat are liable to lose their color subsequently when they come in contact with damp cloths, etc.

Formulas for Staining Shellacs, Alcohol Varnishes and Mattings

REMARK: The figures and amounts given in the following formulas refer to their use for rough, unstained wood; much smaller quantities should be used for woods already stained with water-stains.

No. 146. Light Oak-Brown

3 grams Light Oak-Brown dissolved in 1 liter of shellac or alcohol varnish.

No. 147. Antique-Oak Brown

4 grams Antique-Oak Brown dissolved in 1 liter shellac or alcohol varnish.

No. 148. Walnut-Brown

10 grams Walnut-Brown dissolved in 1 liter shellac or alcohol varnish.

No. 149. Dark-Mahogany

12 grams Mahogany-Brown "D" dissolved in 1 liter shellac or alcohol varnish.

No. 150. Mahogany-Red

12 grams Mahogany-Red dissolved in 1 liter shellac or alcohol varnish.

No. 151. Light-Mahogany

6 grams Mahogany-Brown "H" dissolved in 1 liter shellac or alcohol varnish.

No. 152. Color of Unbleached Shellac

1 gram Polish Yellow dissolved in 1 liter shellac or alcohol varnish.

No. 153. Lemon-Yellow

10 grams Oriole-Yellow dissolved in 1 liter shellac or alcohol varnish.

No. 154. Bright, Blue-Green

10 grams Brilliant-Green dissolved in 1 liter shellac or alcohol varnish.

No. 155. Bright-Red

10 grams Safranine dissolved in 1 liter shellac or alcohol varnish.

No. 156. Dark-Red

7.5 grams Safranine,
6.0 " Mahogany-Red, and
1.5 " Chrysoidine, dissolved in 1 liter shellac or alcohol varnish.

No. 157. Medium-Blue

10 grams Induline dissolved in 1 liter shellac or alcohol varnish.

No. 158. Deep-Black

30 grams Lac-Black dissolved in 1 liter shellac or alcohol varnish.

No. 159. Silver-Gray

1.5 grams Silver-Gray dissolved in 1 liter shellac or alcohol varnish.

No. 160. Silver-Gray Metallic Luster Stain, Soluble in Alcohol

Pour the dry stain into a flat dish and dip into it the damp polishing ball. The stain adheres very readily to the ball and is worked into the surface and fixed by the act of polishing.

When the surface is all covered regularly, give it a coat with bleached shellac in order to protect the metallic luster against rubbing.

Shellac or alcohol varnishes, colored with basic aniline dyes, may be kept a very long time in closed glass bottles or stone jars.

The Coloring of Wax

Because of their direct solubility in wax, Olesole dyes and turpentine staining stock-solutions are excellent for shading, brightening or darkening colors when waxing.

Melt 1 kilogram of white or yellow wax in a glazed or enamelled dish; stir into this when molten 500 cu. cm. of turpentine and add Olesole dyes or turpentine staining stock-solution until the wax seems to have the proper shade. Olesole dyes dissolve very rapidly in hot wax, and if stirred sufficiently with a wooden paddle, give a very regular stain.

When cool and hard, apply the wax with a woolen cloth or a brush to the stained and sandpapered surface. Let harden for a day; then brush with a medium-stiff brush until there is a uniform dull polish.

Such a correction of a stained article by means of wax is wholly practicable; for even if the small amount of Olesole dye in the prepared wax fades out (due to the effect of light), there still remains intact the ground color given by the water-stain, and the change is not considerable.

REMARK: Many cabinet-makers use a siccative with Olesole wax, but this should not be done because linseed varnish ceases to dry as soon as even a slight quantity of Olesole dye is added. The surface is sticky months afterwards and often has to be completely restained.

Process for Subsequent Covering of Unstained Pores of Stained Oak

In the chapter entitled "Preliminary Preparation of Oak for Avoiding Unstained Pores," was mentioned the fact that the deep pores of oak and ash contain air-bubbles which render difficult and often prevent entirely the penetration of the staining solution.

While staining solutions made from chemicals (i. e., Antique-Oak Stains "I," "K," "L," "M" and "S," Anthracene Stains, Special-Oak Stains and Oxidine Stains), may easily penetrate these air-bubbles on account

of their mordacity, and also stain the deep-lying pores of oak and ash without any difficulty in most instances, nevertheless staining solutions made from aniline dyes only imperfectly penetrate into these air-filled pores. When applying these staining solutions to oak surfaces, there is formed a colored film of air over the pores, so that, while wet, they seem to be colored; but when the stained surface dries, this air-film bursts and the unstained pores appear. Preliminary treatment with a 10 per cent. solution of cooking-salt the author found to be the best method of avoiding this when staining oak and ash (see pages 27-28). If for any reason this preliminary treatment was not given, or especially obstinate pores show unstained in spite of it, then they must be covered subsequently.

This may be done without additional work at the time of waxing or matting.

Melt the wax and add the proper Olesole dye for the tone of the stained surface, stirring it in with a wooden paddle until completely dissolved and the wax appears uniformly colored, which should take only a few minutes. Now drop a little of the colored, liquid wax from the wooden paddle on a piece of white paper and compare the hardened drop of wax with the tone of the surface of the wood already stained. If the color of the dyed wax is too light, add a little more Olesole dye; if too dark, add more unstained wax to lighten it. If it is the right tone, take it off the boiling water, let cool and harden, then wax the stained objects in the usual manner. The stained wax settles into the pores of the oak and ash, fills them, and the previously-unstained pores appear the same color as the surface. The tone of the stained surfaces is darkened but slightly if the wax is not colored too strongly and the coat applied is thin.

This treatment also serves to smooth out any irregularities in the previous staining of the surface.

After the wax has hardened, the object should be brushed and then lightly shellacked or matted.

According to the color of the object stained, use the following Olesole dyes for coloring the wax:

Color of Stained Object.	Olesole dye for coloring 1 kilogram of wax.	
1. Oak Brown	About 3 g.	Olesole Oak-Brown
2. Antique-Oak Brown	" 6 g.	" Antique-Oak Brown
3. Walnut Brown	" 10 g.	" Walnut-Brown
4. Dark Brown	" 10 g.	" Walnut-Brown and
	5 g.	" Black "BG"
5. Light Mahogany	" 5 g.	" Mahogany "H"
6. Dark Mahogany	" 10 g.	" Mahogany "D"
7. Dark Red	" 5 g.	" Mahogany "D" and
	5 g.	" Red
8. Olive	" 4 g.	" Green and
	" 1 g.	" Orange "C"
9. Green	" 5 g.	" Green
10. Dark Olive-Green	" 5 g.	" Green and
	" 3 g.	" Blue
11. Dull Blue-Green	" 2 g.	" Green and
	" 3 g.	" Blue
12. Dark Blue	" 10 g.	" Blue
13. Light Dull-Blue	" 2 g.	" Blue
14. Light Blue-Gray	" 1 g.	" Black "B"
15. Medium Gray	" 3 g.	" Black "B"
16. Light Yellowish-Grey	" 1 g.	" Black "BG"
17. Medium Yellowish-Gray	" 3 g.	" Black "BG"
	and so on.	

These amounts per kilogram of wax are only intended for the first trial, and are to be modified according to the depth and shade of tone of the previously-stained surface.

Use white wax for light, delicate and even bright colors, in order not to change their color; and yellow wax (unbleached wax) for brown tones. If for any reason the staining objects are not to be waxed, but immediately matted, the mattings should be colored with a proper aniline dye, soluble in alcohol, as was described in the chapter entitled "The Coloring of Shellacs, Mattings and Alcohol Varnishes with Aniline Dyes, Soluble in Alcohol," (see pages 132 to 133). To do this, dissolve the aniline dye of the proper shade in hot, high per cent. alcohol, and add

this solution to the matting until it has the same tone as the stained surface.

If stained furniture is matted with this preparation, the pores being filled therewith, will show colored.

NOTE—For table of weights and measures, see the following page.

WEIGHTS

1000	grams	=	1 kilogram
1	"	=	15.4324 grains
28.350	"	=	1 ounce
453.660	"	=	1 pound

CUBIC MEASURES

1000	cubic centimeters	=	1	liter
1	" "	=	16.23	minims
29.5737	" "	=	1	fluid ounce
946.358	" "	=	1	quart

LENGTH

1000	millimeters	=	1 meter
25.40	"	=	1 inch
304.80	"	=	1 foot
914.40	"	=	1 yard

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